CHARACTERIZATION OF THE GAS AND LIQUID TRANSPORT RATES AND H_2SO_4 CONCENTRATION AND DISTRIBUTION WITHIN AN ABOVE GROUND, COMMERCIAL SCALE SULPHUR BLOCK

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By

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ABSTRACT

Excess global elemental sulphur (S^o) production has resulted in a decrease in its price. As a result, many companies, such as Syncrude Canada Ltd., have resorted to above ground storage alternatives. Geochemical reactions in these above ground blocks produce elevated concentrations of H_2SO_4 (acid). This acid can have potentially deleterious effects on the environment. As such, these blocks will require long-term (500 years) monitoring and maintenance.

Presently the S^o is removed from the product stream, piped in a molten state, and poured over a low permeability liner in thin lifts. As the S^o cools and undergoes crystal structure change it fractures, creating preferential flow passages which are potentially highly conductive. An understanding of the liquid conductivity (K_l) of the block and knowledge regarding the spatial and temporal distribution of acid (H_2SO_4) within these blocks is required. In this thesis, gas pumping tests were conducted on an above ground block to determine the gas flow rates within the block and to indirectly determine the K_l of the block. Measurements of the relative humidity (RH) in the block were used to observe changes in stored acid concentrations with time and location.

The results of the gas conductivity (K_g) testing showed that the block is anisotropic and is highly conductive in both the horizontal and vertical directions. Cross-hole tests appeared to produce the most representative estimates of K_g due to the negation of turbulence that arises in the vicinity of the borehole. The choice of gas used in the analysis had negligible effect on the resulting K_l in contrast to choice of liquid, which resulted in larger variations in K_l. The K_l was a maximum when the liquid was pure water and decreased with increasing acid strength. The geometric mean of the resulting cross-hole K_l values was 2 x 10^{-3} m s^{-1} (pure water).

RH measurements were observed to fluctuate with depth and increased following precipitation. The resulting minimum pH observed within the block occurred at depths of 3 and 7 meters below the surface of the S^o block and increased with depth. The arithmetic mean pH value based on the daily averaged RH measurements was -1.7.

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CHAPTER 1.
INTRODUCTION

1.1 General Problem

Canada is one of the world's largest producers of elemental sulphur (S^o) while having one of the smallest requirements domestically (Ober, 2001). Historically S^o has been a mined product, however, increasingly stringent environmental regulations requiring the removal of sulphur dioxide and hydrogen sulfide from waste streams have created a global surplus of S^o (Ober, 2001). This surplus has driven down the market price and made it uneconomical for many companies to sell this once valuable product, requiring them to store recovered S^o on site. Non-ferrous metal smelting operations, petroleum refineries and natural gas recovery operations are examples of industries being affected by this over supply.

Typically over the last two decades Syncrude Canada Limited (SCL) has extracted the S^o from its oil sand derived bitumen and stored the recovered S^o on site. The S^o is removed during processing and is then transported and poured in a molten state to form large (typical dimensions on the order of 200 x 100 x 20 m) above ground blocks of solidified S^o. The practice of above ground S^o storage creates a number of operational challenges, including the use of large areas of land and the containment of sulphuric acid (H_2SO_4) effluent from the blocks. The release of H_2SO_4 from within the blocks could have a negative effect on the surrounding environment (Hendry, 2004). Therefore, an understanding of the processes controlling the production and release of H_2SO_4 from these S^o blocks is required to mitigate this potential impact. Once these processes have been identified, designs that can minimize the production or release of H_2SO_4 can be developed and applied to the blocks.

Due to the high projected costs associated with long-term (500 years) maintenance of the blocks, SCL is currently investigating/utilizing alternative strategies such as remelting and selling the S^o regardless of market price or long-term storage of the S^o, possibly through burial of the recovered S^o. The long-term containment strategies must incorporate protection of the natural environment from effluent release and preserve the integrity of the S^o with a view to future extraction.

1.2 Background

Temporary or long-term storage of S^o in large, aboveground blocks continues to be one option for management of surplus S^o in western Canada (Johnson, 2009). This management practice allows companies such as SCL to continue production without interruption until more viable containment alternatives are determined, alternative uses of S^o are developed, or the market price increases (Johnson, 2009).

Currently, there are three large above ground S^o blocks located at the SCL oil sands mine in Northern Alberta. Construction of the first began in 1993 (McKenna, 2004a). All three blocks at the SCL site were constructed in a similar manner, typical of S^o storage facilities across Alberta (McKenna, 2004a).

Typically the S^o is removed from the product stream using a variety of methods and piped in a molten state at temperatures of approximately 150 ^oC (McKenna, 2004a) to a storage facility that is underlain by a low permeability liner. The molten S^o is poured in thin successive lifts ranging approximately 0.02 to 0.12 m thick and allowed to cool and solidify (Bonstrom, 2007). During cooling the block undergoes crystal structure change and shrinkage resulting in the formation of fractures.

One of the most deleterious effects of the above ground blocks is the potential to produce large volumes of high concentration H_2SO_4. The production of H_2SO_4 from S^o can be described by the following relationship (intermediate reactions not shown) [Temple and Delchamps, 1953; Suzuki et al., 1992]:

$$S^{o} + \frac{3}{2}O_2 + H_2O \xleftrightarrow{Thiobacillus} H_2SO_4 \quad [1.1]$$

Although, solid S^{o} is hydrophobic and insoluble, acidifying bacteria act to catalyze the oxidation of the S^{o} resulting in the production of H_2SO_4. Because of the significance of both oxygen (second term of Equation 1.1) and water (third term of Equation 1.1) in the production of H_2SO_4, an understanding of the movement of both water and air within the S^{o} blocks is fundamental to characterizing the controls on acid production and release. To evaluate current storage practices and to develop and test new containment alternatives, an understanding of the physical controls on acid production and distribution within the block is required.

1.2.1 Previous Investigations on the Phase 1 S^{o} Block

The Phase 1 S^{o} block at the SCL site was chosen for field experimentation as the top of the S^{o} block can be accessed by vehicles via a large earthen ramp. A number of previous studies have been conducted on the Phase 1 S^{o} block (~360 m long, 160 m wide, and 18 m high) to define the physical and hydraulic characteristics of the S^{o} blocks and the processes controlling H_2SO_4 production. McKenna (2004a) and Bonstrom (2007) determined many of the blocks physical characteristics (e.g. fracture pattern and spacing and aperture size) through the use of fracture mapping studies, borehole camera study, and general observations of block construction. Bonstrom (2007) undertook both laboratory and field-testing to further define the physical (block matrix and fracture porosity) and hydraulic (matrix and bulk hydraulic conductivity [K]) characteristics of the S^{o} block. Bonstrom (2007) identified the importance of the fractures in the distribution and transport of water within the block. However, due to irregularities in the results of hydraulic packer tests, it was noted that the magnitude of the K could not be confidently defined.

Birkham (2010), Birkham et al. (2010a; 2010b), and Birkham et al. (2011) also undertook studies of the hydraulic characteristics of the block but the main focus of these studies was to define the physical, biological, and chemical controls on the production of H_2SO_4 within the block. Birkham et al. (2010a) noted that observations regarding elevated concentrations of sulphate and low pH of effluent waters suggest that fast flow of both gas (air) and liquid (water) are occurring through the S^o blocks, confirming the importance of fractures in the fate and transport of H_2SO_4 within the block. Birkham et al. (2010a) suggested that acidic effluent produced within the block is diluted by infiltrating fresh water prior to its release. Consequently, the internal pH of stored pore-water was assumed to be greater than effluent chemistry would suggest.

Preliminary measurements of in situ RH were used by Birkham et al. (2010a) as an indicator of the ionic strength of the stored acidic water. These observations suggested the presence of elevated internal acid concentrations. The mechanism responsible for this behavior is likely the presence of preferential flow paths for infiltrating water whereby only part of the stored acidity is mixed and diluted by fresh water prior to being released as effluent.

1.3 Research Objectives

Previous research highlighted the importance of both gas (e.g. oxygen) and liquid conductivity to the production of H_2SO_4 (Equation 1.1) but did not fully characterize the conductivity of the blocks to gas (air) and liquid (water). In addition, the preliminary findings by Birkham et al. (2010a) regarding the storage of high concentrations of acidity within the blocks, requires verification and further characterization. These two issues form the primary foci of this research work as defined by following objectives:

1. Characterize the distribution of the gas conductivity (K_g) within an above ground S^o block and use these data to characterize the hydraulic characteristics of the block; and

2. Establish the spatial and temporal variations in acidity within the blocks to verify the cyclic nature of the internal acid strength due to partial flushing and dilution.

K_g within the S^o block was evaluated using single- and cross-hole gas pumping tests conducted on the Phase 1 S^o block. Analytical and numerical techniques were employed to interpret the field data and estimate the K_g of the block. The corresponding hydraulic characteristics were then inferred from the intrinsic permeability based on the K_g and the properties of the effluent. Fracture characteristics required for the assessment of the gas test data were obtained from borehole video camera work on boreholes constructed as part of this research as well as the results from previous studies (McKenna, 2004a; Bonstrom, 2007; Birkham et al., 2010a). In situ measurements of the RH were undertaken using a number of different approaches and used to characterize the spatial and temporal distribution of stored acidity within the block.

1.4 Thesis Outline

Chapter 1 outlines the basis for this study and provided a brief background of block construction, previous work conducted on the Phase 1 block, and a brief summary of the work conducted as part of this study. In Chapter 2, a synthesis of the literature review conducted as part of this study, is presented to outline the applicable theoretical considerations and numerous materials and analytical methods required to determine the study objectives. The chosen experimental and analytical techniques required to determine the parameters of interest and meet the objectives of this thesis are presented in Chapter 3. Results of the field data collection and analysis are presented in Chapter 4. Where necessary, the materials and methods presented in Chapter 3 are expanded upon in Chapter 4 to provide clarity and context. In Chapter 5, a brief summary outlining the key results and deliverables of this research project is provided.

Recommendations for future study on the Phase 1 block, arising from the results of the current study, are outlined in Chapter 6.

CHAPTER 2.
LITERATURE REVIEW

2.1 Discussion on the use of Terminology in this Thesis

Typically the words "hydraulic conductivity" or the variable "K" are used to describe the fluid conductivity of a medium under an applied hydraulic gradient. Because in this thesis the conductivity of both gas and liquids were considered it was determined that the superscripts and 'g' and 'l' would be used to distinguish between the gas and liquid conductivity of the medium, respectively and will be used in context to distinguish between the two when necessary.

The use of the terms 'gas' instead of 'air' and 'liquid' instead of 'water' were chosen based on the assumption that the fluids within the block do not represent standard atmospheric air or pure water, respectively. As was illustrated by Birkham et al. (2010a) the gas constituents (discussed later on) within the block are consistent with that of standard air but the proportions of each constituent are variable. Similarly, observations of elevated concentrations of sulphate and low pH (H_2SO_4) of block effluent illustrate that the internal stored acidity of the block was of extremely low pH and therefore, was assumed to have physical characteristics distinctly different than that of pure water. As such the term gas was used to distinguish between gases different from air and liquids of variable concentrations of H_2SO_4 acid.

2.2 Introduction

This chapter provides background information on the construction of the S^o blocks and the dual porosity pore structure that develops within these blocks over time. The chapter also summarizes relevant literature related to flow through dual porosity media as well as theoretical developments, which are drawn upon later in the interpretation of the test results. Finally, a short section describing the relationship between pore fluid acidity and the relative humidity (RH) of the air that is in equilibrium with an acid solution is presented.

2.2.1 Block Construction

The S^o block storage facility at the SCL site is constructed in a similar manner to others around the world (Birkham et al., 2011). There are currently three phases of block construction at the SCL mine site. Construction of the first above ground S^o storage block at the SCL mine site was initiated in 1993 with the construction of a low permeability liner of clay and lean oil sands followed by initial pouring of the S^o block in late 1993. S^o blocking is achieved by pouring molten S^o in thin lifts of varying thickness from 0.02 to 0.12 m (Bonstrom, 2007). The molten S^o is piped at temperatures of approximately 150 ^oC to the storage facility, poured inside metal forms from towers located along the center or edge of the block, and is then allowed to cool and solidify (Figure 2.1). Once a desired thickness has been achieved the metal forms are moved and the next pour is initiated. The forms are moved periodically in order to distribute the S^o evenly over the previous pour resulting in the appearance of stacked blocks, which are stepped inward after vertical side walls approximately 1 to 3 m high have been formed.

The northeast corner of the completed Phase 2 block shown in Figure 2.1 illustrates the typical staged construction of a S^o block. The current study was completed on the Phase 1 S^o block at the SCL mine site as the block could be accessed by an earthen ramp on the western side of the block. The dimensions of the Phase 1 block are approximately 380 m long by 170 m wide and 17 m high (Bonstrom, 2007). Construction of the Phase 1 block was completed in 2004, however, since this time, additional material has been added to the surface of the block (Birkham, 2010).

2.2.2 Formation of the Block Pore Structure

The pore structure within the block is due to a number of processes including volume change, crystal structure change, and the method of block placement. The primary means of pore structure development is volume change. As the temperature of the molten S^o declines to approximately 119 ^{o}C the liquid S^o begins to solidify and there is a reduction in the volume of the S^o of about 7 %. At temperatures just below its melting point, the S^o takes on a monoclinic crystal structure. Further cooling of the S^o causes the crystal structure to change from monoclinic to orthorhombic, the most stable form of elemental S^o below room temperature (approximately 23 ^{o}C) and results in a further reduction of the volume by approximately 5.5 % (Meyer, 1977).

Figure 2.1 Photograph of emergency pour on the Phase 1 S^o block surface. Metal forms and a hose can be seen in the bottom of the image. The reddish colored material in the center of the image is freshly poured molten S^o. The image was taken from the surface of the Phase 1 block looking west towards the northeast corner of the Phase 2 block.

The volume changes due to cooling and crystal reorientation result in the formation of both vertical (Figure 2.2) and horizontal fractures (Figure 2.3). Vertical fractures on the surface of the S^o block were found to occur mainly in a polygonal pattern with the number of fractures increasing with the age of the block (Bonstrom, 2007). Bonstrom noted that horizontal fractures visible on the sides of the block were coincident with apparent lift interfaces and in some instances exhibited a dark staining most likely due to the accumulation of wind blown sediment. Some vertical fractures were identified to intersect numerous horizontal fractures illustrating the interconnectivity of the fracture network. Although it is postulated that the fractures are the

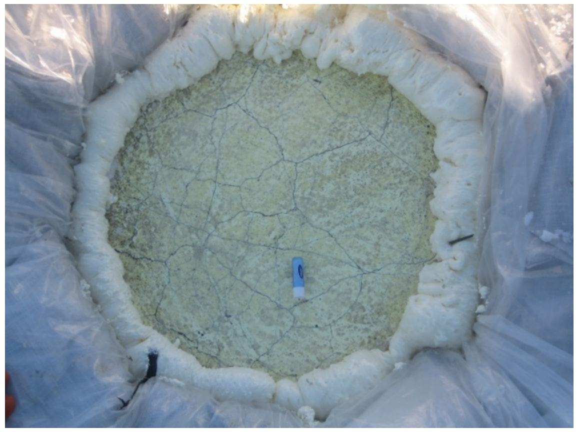

Figure 2.2 Photograph of surface of S^o block illustrating polygonal pattern of vertical fractures. Photograph was taken during the construction of ring infiltration experiment. The circle is constructed of expansive foam to adhere a plastic liner to the block.

Figure 2.3 Photograph of a ledge near the surface of the S^o block containing various horizontal and vertical fractures. The spacing of the horizontal fractures in the image is on the order of 0.03 to 0.05 m with small vertical fractures intersecting multiple horizontal fractures.

primary conduit for fluid movement within the block, the majority of the block consists of matrix pore space. It has been suggested that the matrix porosity (Figure 2.4) is formed due to air trapped within the surrounding crystal structure (Bonstrom, 2007).

Bonstrom identified matrix pores, visible to the naked eye, up to 10 mm in diameter. The mean diameter of the 'visible' matrix pores were identified to be between 1 to 2 mm, although, much of the matrix porosity was not visible without the aid of a microscope.

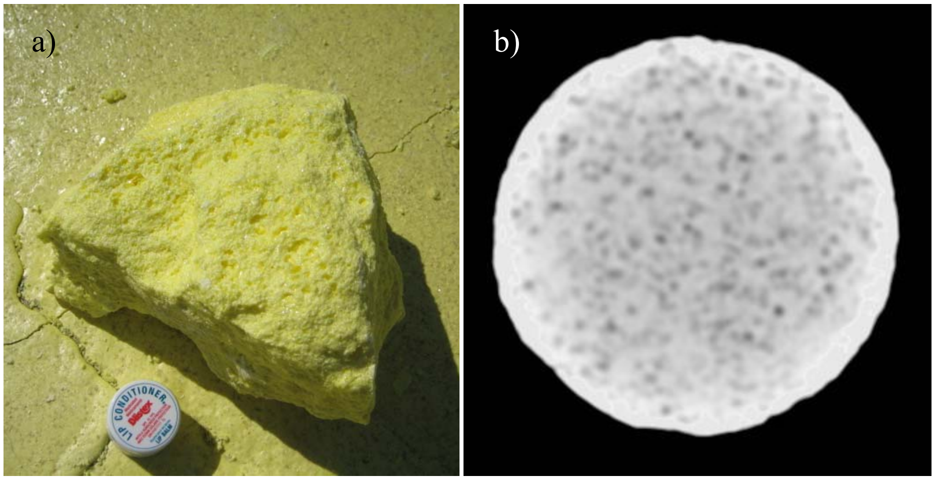

Figure 2.4 a) Photograph of the underside of a small block of S^o excavated from the surface of the S^o block. Image illustrates visible porosity of the S^o block. b) CT image showing matrix with visible pores (0.1 to 1 mm diameter; taken from Bonstrom 2007).

The method of block placement also has an impact on the pore structure of the block. As the S^o material is poured from one of several pouring towers staged around the block, the pouring tends to be concentrated in one area for an extended period of time and the elevated temperatures of the molten S^o causes previously solidified S^o to melt. This process not only affects surface material but may also melt S^o at depth (R. Carter, personal communications). Additional melting will occur as the molten S^o flows over the surface of the block creating erosion channels in the S^o surface (Figure 2.5). Re-melting resulted in the destruction of the original and apparently uniform pore structure leading to the formation of a potentially more erratic pore structure.

2.2.3 Hydraulic and Chemical Behavior of Above Ground S^o Blocks

Research has been conducted to define the physical and chemical characteristics of the above ground blocks. Bonstrom (2007; Bonstrom et al., 2009) conducted both laboratory and field-tests to identify the percent of the pore space attributed to the matrix and fractures. Bonstrom (2007) found that the matrix pores occupied most of the total pore space (total matrix porosity – 0.094; matrix porosity available for water flow – 0.065) with the fractures (fracture porosity –

0.014) comprising only 10 to 23 % of the total pore space. However, based on the fact that elemental S^o is hydrophobic, Bonstrom (2007) estimated from porosimetry measurements that 1 to 2 m of

Figure 2.5 Photograph of live pouring on the Phase 3 S^o block at the SCL mine site. Image illustrates the melting of previously solidified S^o due to the pouring process. Molten S^o is flowing away from the pouring location and creating a river like erosion channel in the S^o block surface.

positive water pressure head was required in order for water to enter the matrix pores. Despite the fact that the fractures comprise only a relatively small percentage of the pore space, they were identified as the primary conduit for fluid movement within the upper 9 m of the block. Bonstrom (2007) also demonstrated that the K of the fractures was likely 1 to 2 orders of magnitude greater than that of the matrix. It was hypothesized that only in the deeper portions of the block would there be a sufficient reduction in the fracture conductivity, coupled with a larger height of ponded water, for the matrix to provide a noticeable contribution to fluid flow. Bonstrom concluded that the block could be considered a hydrophobic, variably saturated, fractured porous medium.

Birkham et al. (2011) reached a similar conclusion regarding the block characteristics. Birkham et al. (2011) conducted water repellency tests on both the matrix and block fractures and illustrated that the matrix and yellow unexposed fractures were moderately to extremely water repellent. Exposed dark stained fractures ranged from being hydrophilic to only moderately water repellent. Birkham et al. (2011) conducted water content measurements on core samples recovered from the Phase 1 block to determine the volume of water available for acid production. The block was identified to have a low water content (0.6 %) irrespective of the time of measurement relative to antecedent precipitation events. This suggests that the block is free draining and confirms the suggestion that the block is unsaturated.

To determine the relative contributions of the fractures and matrix to fluid flow within the block, Birkham et al. (2011) conducted water infiltration tests spiked with a blue dye. Upon excavation of the S^o material in the vicinity of the infiltration test, Birkham et al. (2011) discovered that water flowed preferentially through fractures. Although water was found to have entered the S^o matrix in areas containing discrete fractures, it was noted that the presence of the blue dye reduced the hydrophobicity of the S^o to the dye stained water. In the case of infiltrating fresh water, it is less likely that water would be imbibed into the S^o matrix. Birkham et al. (2011) simulated the basal pore-pressure response to isolated precipitation events in an attempt to estimate the K of the block. Based on a match between the simulated and measured outflow at a weir located downstream of the block, Birkham et al. (2011) determined the bulk K to be between 1×10^{-1} and 1×10^{-3} m s^{-1}. These values were in striking contrast to the lower K values measured by Bonstrom (2007) in packer tests; however, those tests have been brought into question due to the potential clogging of the fractures with S^o dust during borehole drilling. The bulk K values estimated by Birkham et al. (2011), however, are still orders of magnitude greater than the matrix K values measured by Bonstrom (2007), highlighting the fact that the fractures are the primary conduit for fluid movement in the S^o block.

2.2.4 Implications of Above Ground S^o Storage

Equation 1.1 highlights that the production of H_2SO_4 requires the availability of both oxygen and water and is catalyzed by acidifying bacteria. Birkham et al. (2011) showed that the blocks, constructed above ground, are rapidly draining, highly fractured, and unsaturated (consequently contain a nearly constant volume of water) and have unrestricted access to oxygen. Effluent from the blocks was found to have low values of pH (0.4 to 1.0) and contain elevated concentrations of sulphate consistent with the production of H_2SO_4 (Birkham et al., 2010a). Birkham et al. (2010a) hypothesized that the concentration of the stored acidity within the block could be much greater and the lower acidity within the effluent was likely the result of mixing of fresh infiltration water and stored acidic water prior to its release. Birkham et al. (2010a) estimated the internal acid concentration within the block by measuring the RH of pore gas drawn from gas sample points within the block. Based on these measurements it appeared that the internal acid concentration might be orders of magnitude greater than that measured in block effluent.

2.3 Identification of Relevant Test Techniques

These previous studies demonstrated that the SCL S^o blocks are a variably saturated, hydrophobic, fractured porous media (Bonstrom, 2007; Birkham et al., 2010a, 2011). In an extensive search of the literature no studies were found that described the flow of water in a hydrophobic, variably saturated, fractured porous medium. However, studies of water flow in sandy water-repellent soils (Ritsema and Dekker, 2000) and the flow of dense non-aqueous phase liquids in soil (Kueper and McWhorter, 1991) may be considered analogous and help highlight the potential effects of hydrophobicity on water flow. To describe the potential effect of hydrophobicity on the storage of water within the blocks, Bonstrom (2007) adapted the constitutive equation of Van Genuchten (1980) to develop a relationship between the degree of saturation and capillary pressure. Bonstrom (2007) modified this relationship to account for the fact that only positive pressures will result in an increase in the water content within a hydrophobic material.

From a preliminary review of the literature of variably saturated, fractured porous, media the most significant findings regarding fluid flow in such systems, is the complexity arising from variable saturation, heterogeneity of the fracture network, and the development of preferential flow paths. The overarching conclusion from the literature on these types flow problems is that large-scale field measurements are required to characterize relevant properties. This requirement arises because conductivity has been shown to be highly scale dependent (Rasmussen et al., 1993; Rovey and Cherkauer, 1995; Schulze-Makuch et al., 1999; Whitaker and Smart, 2000; Illman and Neuman, 2003; Illman, 2006). Scale effects are purported to be related to heterogeneous features such as vug porosity, fissures, cavernous porosity, transmissive linked macropores, and fractures (Bradbury and Muldoon, 1990; Rasmussen et al., 1993; Whitaker and Smart, 2000), many of which are poorly preserved or may not be recovered through core sampling (Rasmussen et al., 1993; Illman, 2006). Many of these types of features have been identified during physical studies of the S^o blocks (Bonstrom, 2007). Therefore, it was felt that field-testing would provide estimates of the conductivity that more accurately reflect the bulk properties of the S^o blocks.

There are a variety of field scale tests that have been used to determine the hydraulic characteristics of unsaturated media including:

- Guelph Permeameter Tests (Reynolds and Elrick, 1986; Elrick et al., 1989);
- Falling Head Tests (Bagarello et al., 2004; Rodgers and Mulqueen, 2006);
- Water Pumping Tests (Hsieh, 2000);

- Water Injection Tests (Rasmussen et al., 1990);
- Pneumatic Injection Tests (Rasmussen et al., 1990, 1993, 1995; Lecain, 1995, 1998; Basset et al., 1997; Guzman et al., 1996; Cook, 2000); and
- Pneumatic Pumping Tests (Edwards and Jones, 1994; Baehr et al., 1989; Massmann and Madden, 1994; McWhorter, 1990).

Despite the array of available tests, it has been observed that hydraulic tests in unsaturated fractured rock can be difficult to undertake (Illman, 2006; Illman and Neuman, 2003). Difficulties arise in the planning and implementation of such tests, as well as technical difficulties in data interpretation due to variable saturation. Although the S^o blocks are constructed above the ground surface on a low K liner, their highly fractured nature and corresponding high K allows water to infiltrate quickly through the block. Near saturated conditions were noted to exist only near the bottom of the block where a water table is perched above the low permeability liner (Birkham et al., 2011).

In addition, the S^o block matrix is hydrophobic and consequently restricts the entry of water unless sufficient positive pressures develop (Bonstrom, 2007). This enhances rapid drainage of the blocks following precipitation with flow hypothesized to occur along open fractures. Variable degrees of saturation are associated with partial penetration of the matrix pores by water depending on whether positive pressures develop either in isolated fractures or along the base of the pile where ponding occurs over the liner.

Many researchers have illustrated that a viable alternative method of determining the conductivity of various media is the use of gas tests (Baehr and Hult, 1991; McWhorter, 1990; Rasmussen et al., 1990, 1993, 1995; Edwards and Jones, 1994; Basset et al., 1997; Cook, 2000; Illman and Neuman, 2000, 2003). Gas tests offer key advantages over hydraulic tests: the effect of gravity can be neglected, steady-state conditions are reached more quickly, and data interpretation errors due to variable saturation are minimized (Rasmussen et al., 1993; Leven et al., 2004). In addition, gas tests eliminate the injection of a liquid, which may alter the physical and chemical conditions of the site (Cook, 2000; Rasmussen et al., 1993).

The foremost advantageous reasons for the use of gas tests in the case of the S^o block, was to eliminate the introduction of large quantities of water which might alter acid production and effluent generation and to circumvent the complexities associated with variable saturation. In addition, the use of gas rather than hydraulic tests increases the possibility of obtaining in situ RH measurements that are representative of the 'normal' conditions of the block.

2.3.1 Gas Test Techniques

Two types of gas tests are commonly conducted: injection (Rasmussen et al., 1990, 1993; Guzman et al., 1996; Basset et al., 1997; Cook, 2000; Illman and Neuman, 2000, 2003) and pumping tests (Baehr et al., 1989; Massmann, 1989; McWhorter, 1990; Edwards and Jones, 1994; Massmann and Madden, 1994). Although both tests have been applied successfully to different types of variably saturated fractured porous media, the use of gas pumping tests has been determined to be most suitable for the testing on the S^o block. The rationale for the use of pumping tests rather than injection tests is based on concerns about potential plugging of the fractures with the fine S^o dust produced during drilling. In injection tests these dust particles would be forced into the fractures, decreasing their conductivity.

There are a number of gas test methods that are typically employed in field-testing programs. However, the two most common test methods are single- and cross-hole tests. The procedures for both the single- and cross-hole tests are nearly identical. The identifying feature of the cross-hole test is that the pressure response is monitored in both the pumping interval and at adjacent monitoring locations. Cross-hole tests have the advantage that they can give information regarding anisotropy (Hsieh and Neuman, 1985; Illman and Neuman, 2003), interconnectivity of the fracture network (Basset et al., 1997; Cook, 2000), scale effects (Illman, 2006), and may help to assess the applicability of an equivalent porous medium type numerical model. Vertically nested gas sampling ports constructed using continuous multichannel tubing (CMT) had been previously installed in the Phase 1 block for the measurement of gas concentrations within the block. It was determined that cross-hole tests could be conducted on the S^o block without incurring significant additional costs by employing these installations as monitoring points. Therefore, it was determined that both single- and cross-hole tests would be conducted on the S^o block.

It should be noted that for the remainder of this thesis, the word 'CMT' will be used to describe a nest of gas sampling ports unless used in the context of a construction material and in these cases will be designated as such in brackets "(material)".

2.4 Implications of Gas Tests

Although gas tests appear to offer many advantages over hydraulic (i.e. water) tests, differences between the flow of gas and liquid within the S^o block must be considered. The primary concern was identified to be whether or not the gas and water would flow preferentially through the same pathways. This was considered since the purpose of the test program was to use the gas conductivity (K_g) results to estimate the liquid conductivity (K_l) of the S^o block. The S^o is not capable of producing negative water pressure and will therefore not imbibe water into block matrix (Bonstrom, 2007). Therefore, residual water must remain within the block fractures. Because it has been illustrated that the presence of water will inhibit gas flow (Tuli et al., 2005), the location of residual waters within the fractures may limit the availability of fractures to gas flow.

Various conceptual models have been proposed to account for the mechanisms controlling water flow in unsaturated fractured porous systems. Commonly the system is idealized as two separate pore space structures (fractures and matrix) that interact with each other. In this conceptual model infiltrating water is absorbed into the matrix under high negative matric potentials (low saturation). As the matrix nears saturation (near zero matric potential), water flow begins to occur through the fractures. Flow will occur first through water-connected pathways with the minimum aperture (Figure 2.6a).

Contrastingly, Tokunaga and Wan (2000, 2001) proposed that at near zero matric potentials water flow would occur through a thin film of water on the fracture surface, rather than through areas of minimum aperture (Figure 2.6 b). Similar findings regarding the importance of film flow in the movement of water in unsaturated media have been reported by others (Goss and Madliger, 2007). It has been illustrated that water flow in hydrophobic materials will occur preferentially through areas that exhibit slightly more hydrophilic conditions (Bauters et al., 2000). Birkham et al. (2011) identified dark stained fractures that appear to exhibit the most hydrophilic conditions within the block. Consequently, it is hypothesized that water flow through the S^o block at low degrees of saturation is most likely to occur along thin films on the fracture faces, similar to the concept proposed by Tokunaga and Wan (2000, 2001).

It is well known that the K_l of a medium will be a maximum when the medium is fully saturated and will decline with decreasing saturation. Inversely, the rate of gas flow will decrease with increasing liquid saturation, as the presence of liquid will constrict gas flow (Tuli et al., 2005). It has been shown that, similar to water, gas flow will also occur preferentially through the fracture network (Guzman et al., 1996; Illman and Neuman, 2000; Leven et al., 2004). Therefore, the presence and location of any stored water will be critical in the movement of gas through the block. If it can be assumed that residual water within the block is located on the fracture faces it would be reasonable to assume that gas flow in the block will be accessing the same pores as would be accessed by water under saturated conditions.

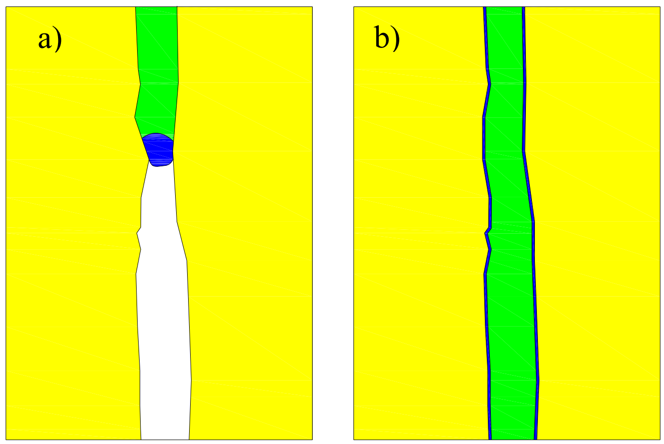

Figure 2.6 Schematic of conceptual unsaturated flow models: a) water exiting pores at fracture minima b) water remaining as a thin film on fracture face.

It is widely accepted that, for porous media, the flow of both gas and liquid are in fact analogous if the underlying assumptions of Darcy's law are maintained (Klinkenberg, 1941), that is: the flow is laminar and head loss occurs primarily through viscous forces. If these assumptions are valid the physical characteristics (fluid resistance) can be described by what is typically referred to as the intrinsic permeability (Bloomfield and Williams, 1995):

$$k = \left(\frac{K}{g}\right)\left(\frac{\mu}{\rho}\right) \qquad [2.1]$$

where k is the intrinsic permeability (m^2), K is the fluid (gas or liquid) conductivity ($m\ s^{-1}$), g is the acceleration due to gravity ($m\ s^{-2}$), μ is the dynamic viscosity (Pa s), and ρ is the fluid density ($kg\ m^{-3}$). The k of a medium is governed only by the physical properties of the medium and should be statistically similar irrespective of whether it is determined using gas or liquid (Cook, 2000).

Although, the k as measured using gas or liquid should be similar, differences have been noted by researchers and have been characterized as being the result of the following: gas slippage (Klinkenberg, 1941; Bloomfield and Williams, 1995), gas compressibility (Edwards and Jones, 1994), and variable saturation (Rasmussen et al., 1993; Leven et al. 2004). Among the many differences reported between gas and liquid flow, the most notable is that described as the Klinkenberg (1941) slip flow effect. It has been noted by various researchers that slip flow effects are greatest in smaller diameter pores (smaller in size than the mean free gas path) and are negligible in larger flow pathways (Massmann, 1989; Rasmussen et al., 1995; Edwards and Jones, 1994). Tests conducted on core samples taken from the S^o blocks using both hydraulic and gas test techniques were found to produce nearly identical values of k (Bonstrom et al., 2009). Therefore, slip flow effects should be negligible as the primary fluid conducting pore space encountered within the commercial scale block field tests will be much larger than those encountered in core tests.

It has been illustrated that an integral component of any test program should be the use of multiple rate tests as they can be used to assess whether or not slip flow effects (Guzman, 1994-discussed in Rasmussen et al., 1995; Lecain, 1995), borehole storage/compressibility effects (Basset et al., 1997; Edwards and Jones, 1994), turbulent flow (Lecain, 1995), or the removal of water (Guzman et al., 1996; Basset et al., 1997; Cook, 2000) are occurring.

2.4.1 Validation and Characteristics of Fracture Flow

It has been suggested that preferential flow, as is hypothesized to occur in the S^o blocks, is associated with the presence of large or highly interconnected fracture networks (Witherspoon and Gale, 1983; Salve et al., 2002; Illman and Neuman, 2000; Martinez-Landa and Carrera, 2006). Gas or liquid flow through preferential pathways (fracture pore space) is typically much greater than through the surrounding porous matrix. Therefore, the resulting conductivity measured using gas tests, as conducted in this study, should be identifiably larger than the matrix conductivity values reported by Bonstrom et al. (2009). This would confirm that fracture flow is the primary conduit for fluid flow in the S^o block.

To properly assess the contribution of both vertical and horizontal fractures on fluid flow, both vertical and angled boreholes were excavated in the S^o block. It has been shown that vertical boreholes have a greater probability of intersecting only horizontal fractures (Geier and Tiren, 2004, Rasmussen et al., 1990), whereas angled boreholes would have a greater probability of intersecting both horizontal and vertical fractures as illustrated in Figure 2.7.

2.5 Internal Acid Concentration

The low pH of the block effluent (Birkham et al., 2010a) has raised concerns regarding the magnitude of acid concentrations within the block. Birkham et al. (2010a) obtained measurements of the in situ RH, to determine the strength of the stored acidity and illustrated that the internal acid strength may be significantly greater than originally suspected based on evaluation of block effluent. The underlying theory for the use of in situ measurements of RH as a tool to evaluate the internal acid strength is derived based on the principal that the energy of the water in a solution is equivalent to the energy of the water in the vapor phase at equilibrium (Warrick, 2002). This relationship can be described using the Kelvin equation (Warrick, 2002):

$$RH = e^{\left(\frac{\psi_T M_w}{RT\rho_l}\right)} \qquad [2.2]$$

where ψ_T is the total liquid potential (Pa), R is the universal gas constant (8.31 J K^{-1} mol^{-1}), T is the absolute temperature (K), ρ_l is the liquid density (kg m^{-3}), M_w is the molecular weight of water (0.018 kg mol^{-1}), and RH is the relative vapor pressure.

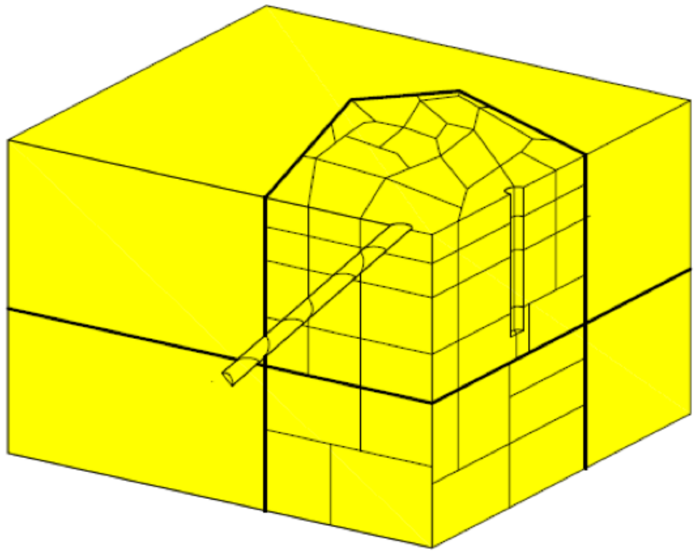

Figure 2.7 Conceptualized S^o block cross section illustrating the number and orientation of fractures that will be intersected by vertical and angled boreholes.

The RH above a pure water under standard conditions of temperature and pressure will approach 100% once equilibrium has been obtained and can be arrived at mathematically by applying a total potential of 0 kPa in Equation 2.2. From Equation 2.2 it can be seen that depression of the RH will occur as the liquid potential is reduced (greater negative value).

In an unsaturated geologic medium, changes in the total potential of the pore fluid are typically attributed to the influence of both the matric and osmotic potential (Warrick, 2002):

$$\psi_T = \psi_m + \psi_s \qquad [2.3]$$

where ψ_m and ψ_s are the matric and osmotic potentials (kPa), respectively. Matric potential within an unsaturated media is the product of capillarity and absorptive forces (Wilson, 1980). Osmotic (chemical) potential is the due to the presence of solutes within a water solution, which act to reduce the water activity (Warrick, 2002). In the case of negligible matric suction, decreases in RH can be attributed only to osmotic potential. As it has been shown that the S^o block is incapable of generating matric potential (Bonstrom, 2007) any depression of the RH within the S^o block can be attributed solely to changes in the osmotic potential. For negligible matric potential contributions, Equation 2.2 can be reduced to the Robinson and Stokes (1968) equation for the thermodynamic equilibria of a solvent:

$$\pi = \frac{RT}{V_A} \ln a_w \qquad [2.4]$$

where ψ_s is the osmotic potential, V_A is the partial molar volume (mol m^{-3}), and a_w is the water activity of the solution. Although, RH is not directly defined in Equation 2.4, it can be determined based on the suggestion that for practical purposes, when equilibrium between the liquid and vapor phases has been attained, the water activity is equivalent to the ratio of the partial and saturated vapor pressure (Reid, 2010).

Several studies have been conducted to relate the H_2SO_4 concentration to the relative vapor pressure (Wilson, 1921; Greenewalt, 1925) or equivalent water activity (Robinson and Stokes, 1968; Staples, 1981). A comparison of data from these studies shows a relatively good correlation and therefore, the data of Wilson (1921) was used in the evaluation of the RH data within the S^o block as it presented the most direct relationship between vapor pressure and H_2SO_4 strength. However, a relationship was required to convert from the weight percent H_2SO_4 data of Wilson (1921) to an equivalent pH. No easily applied method is available to convert from percent weight to pH because of the complexity of the dissociation of H_2SO_4, as it requires the solution of numerous simultaneous equations. Nordstrom et al. (2000) developed a geochemical model to determine the resulting pH for various molal concentrations of H_2SO_4. The data of Nordstrom et al. (2000) was used to convert the weight percent of Wilson (1921) to an equivalent pH and the resulting relationship between RH and pH is presented in Figure 2.8. As can be seen from Figure 2.8, only pH of less than 0 will cause a suppression of the RH.

To date, the only relevant information identified regarding the in situ measurement of RH in an environment similar to the S^o block is that of Birkham et al. (2010a).

2.5.1 Suppression of the RH: Increased Osmotic Potential or Naturally Occurring?

Prior to implementing the use of RH measurements within the block, a literature review was undertaken of studies in which RH had been measured in the field. This was done in order to determine if a suppression of the RH due to changes in water content, matric potential, or atmospheric conditions could occur within natural geologic materials.

Goss and Madliger (2007) used measurements of RH in a dry Tanzanian soil to determine the types of water transport that occurred, within or near the evaporation surface. The area of Tanzania in which the study took place has an extremely dry climate over the summer months, with a mean precipitation of 71 mm from July to October. Over the study period, only two rainfall events occurred with a total of 2.2 mm precipitation. Despite the intentions of the research, this paper illustrated that even in an extremely dry climate the RH within the soil layer remained near 90% for even the most shallow measurement depth (1.5 cm below the ground surface) and only declined below this value during the driest portion of the study period. The RH measurements for a depth of 6 cm below ground surface were consistently between 90 to 95%. Even during the dry period, the RH measurements for the 6 cm depth never dropped below 85%.

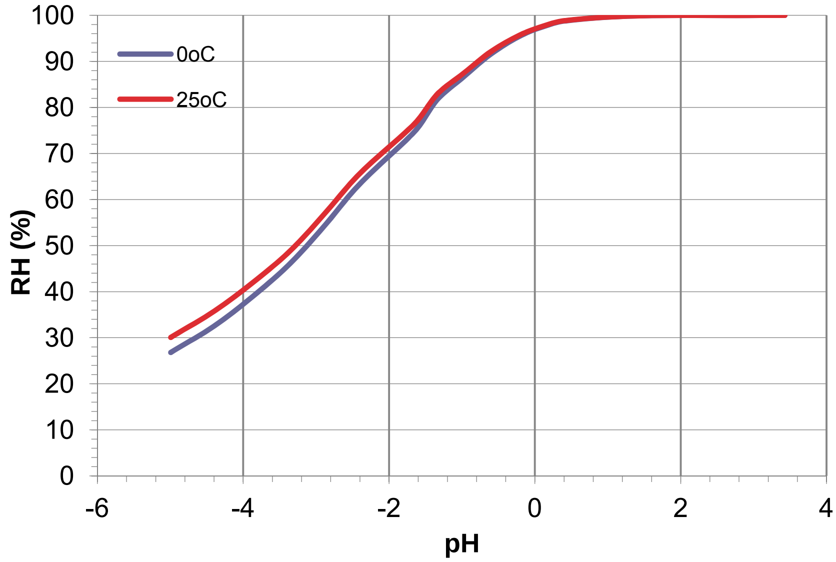

Figure 2.8 Relative humidity versus pH (H_2SO_4) for temperatures of 0 and 25 ^oC. Curve was compiled from data of Wilson (1921) for the relationship between the relative vapor pressure and percent weight H_2SO_4 and converted to the equivalent pH using the relationship of Nordstrom et al., (2000). Irregularities in the curves are due to interpolation in the conversion from weight percent H_2SO_4 to pH.

Birkham et al. (2011) noted that the amount of evaporation occurring on the surface of the S^o block was small (mean 0.2 mm day^{-1}), only about 8.6 % of the potential evaporation. Given that the annual precipitation in Fort McMurray greatly exceeds that observed by Goss and Madliger (2007) and the fact that very little water is lost from the S^o blocks by evaporation, the resulting pore space within the block should remain at 100 % at all depths. Therefore, any measurement of the RH below 100 % would most likely be caused by a decrease in the water activity due to elevated concentrations of H_2SO_4.

2.5.2 Implications of High Osmotic Potential

In addition to using RH as a means of evaluating the strength of stored acidity, its relation to the osmotic potential in general may provide insight into the types of containment alternatives that may not be suitable for storage of the S^o. Because some potential containment solutions may rely on saturation or the integrity (no cracks) of the geologic media to inhibit gas flow (i.e.

clay liner), high osmotic potential could present concerns for long-term storage alternatives. Although, a detailed study regarding potential desiccation was not conducted, the relationship between RH and osmotic potential is shown below in Figure 2.9 for illustrative purposes.

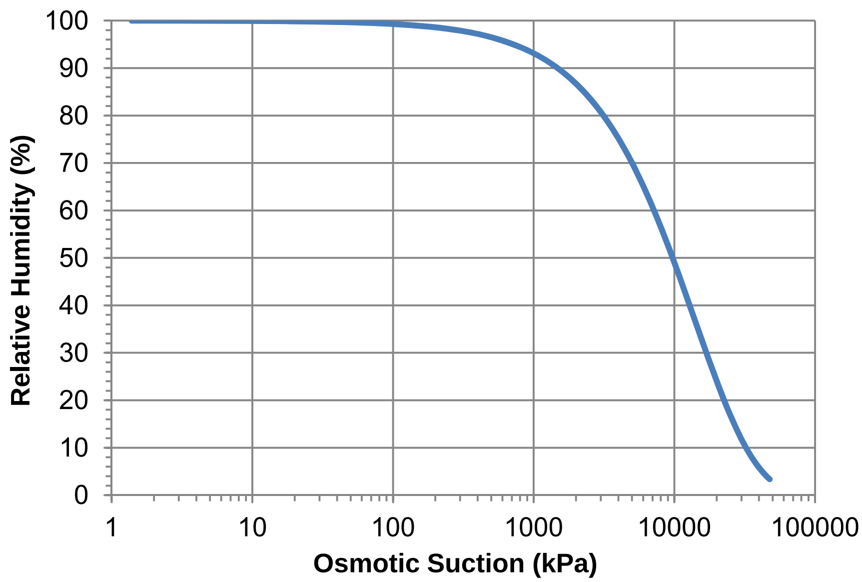

Figure 2.9 Relative humidity versus the osmotic potential calculated using Equation 2.2 and the water activity data of Staples (1981).

2.6 Synthesis of Literature Review

On the basis of the literature review, it has been illustrated that fluid flow within a fractured porous media, occurs predominantly through the fractured pore space. At low levels of liquid saturation, fluid flow within the fractures is conceptualized to occur predominantly along the fracture faces. It has been shown that determination of the liquid transport rates of variably saturated media using hydraulic test methods is fraught with logistical challenges. Numerous studies have illustrated that gas flow at low levels of liquid saturation can be considered analogous to liquid flow at full liquid saturation. Therefore, a viable alternative to determine the liquid transport properties of fractured porous media under variably saturated conditions is to use gas test techniques as a surrogate to typical hydraulic tests. It is anticipated that the results of this thesis will provide further verification of the use of gas test methods to characterize the liquid transport properties of hydrophobic, variably saturated, fractured, porous media.

Studies of geologic media in arid environments, have illustrated the RH of shallow surface soils will remain near 90%, irrespective of evapotranspiration. Numerous studies have illustrated suppression of the water activity (analogous to RH at equilibrium between the vapor and liquid phases) due to increases in the total potential of the solution. In geologic media changes of the total potential are a result of changes of the matric and osmotic potential. Due to the combination of increased levels of precipitation at the Syncrude mine site, relative to an arid environment, and negligible evaporation from the sulphur block (high albedo of the Phase 1 block), the RH within the Phase 1 block should remain near 100% at all times. Studies conducted on the Phase 1 block have illustrated that the block is incapable of producing significant matric suction. Therefore, any suppression of the RH within the Phase 1 block would be a result of increasing osmotic potential (increasing H_2SO_4 concentration). With the exception of a previous study on the Phase 1 block by Birkham et al. (2011), no studies relating the measurement of RH within geologic media to changes in acid concentration have been observed. Therefore, the results of this study will help provide a foundation for the use of in situ measurements of RH, as a tool to determine the solute concentration of geological media.

CHAPTER 3.
EXPERIMENTAL AND BASIC ANALYTICAL METHODOLOGY

3.1 Introduction

In the previous chapter, a synthesis of the available literature was presented to highlight the mechanisms of fluid movement within the S^o block. This included a summary of work completed to date on the Phase 1 S^o block and a synthesis of the literature relevant to the specific objectives of this research. This was done to identify appropriate methods to characterize the conductivity of the S^o blocks and measure the strength of acid stored within the blocks. The following chapter will outline in detail the methodology that was employed in the current study.

3.2 Introduction and Preliminary Test Methods

The key property required characterizing gas and liquid movement within the S^o blocks is conductivity (for gas and liquid phases). The geochemical conditions within the block are characterized by the distribution (spatial and temporal) of the stored acidity within the block. This chapter describes the methods used to characterize these properties and conditions within the Phase 1 S^o block at the SCL Mildred Lake mine site.

It was noted during a review of the hydraulic packer testing conducted by Bonstrom (2007) on the Phase 1 block that the pressure response and fluid flow was irregular and led to inconsistent values of K for a single test. It was believed that these inconsistencies could have been caused by clogging of the fractures by S^o dust produced during drilling of the boreholes or by hydraulic fracturing caused by the use of injection pressures greater than the overburden pressure.

Preliminary testing of K on the standpipe piezometers, installed by Birkham (2010), indicated that the riser pipes within these wells were damaged. As a result, a decision was made to drill new boreholes in which to undertake conductivity testing and obtain measurements of the RH within the S^o block. It was also decided that only gas conductivity testing would be undertaken and that this testing would be undertaken under conditions in which gas was only withdrawn from the block. The use of pumping tests with only gas addresses a number of potential problems. As no water was added and only in situ gas was extracted from the block, disturbance of the in situ water chemistry was minimized. The use of gas also allowed a simpler field set up to be used as only a pump was required to extract gas from the block rather than stockpiling large volumes of liquid to inject into the block. Finally, the interpretation of the data is also simpler since the interpretation was based only on the flow of a single phase under steady-state conditions rather than that of a saturated/unsaturated flow system under transient conditions, as would be case if water were used as the test fluid.

3.3 Borehole Construction

Excavation of the test boreholes was undertaken without the use of water as a drilling fluid and in a manner that would minimize clogging of fractures with fine S^o dust. The use of water as a drilling fluid could inhibit the movement of gas and would therefore render the gas test data erroneous. In addition, the presence of free water would disturb the low RH conditions to be measured within the block.

A preliminary drilling program was undertaken to evaluate two alternate drilling methods: sonic (rapid vibration) and solid stem auger drilling. The sonic method was selected first because it was believed that this technique might provide an efficient method of drilling without the addition of water and could produce core samples that could be used for fracture characterization. However, during field trials it was observed that the heat generated by the drill vibrations caused the S^o to melt (temperature was not measured during this stage of drilling). Upon removal of the drill flights it was observed that a layer of re-solidified S^o covered the casing (Figure 3.1). An examination of the borehole using a down-hole camera verified that there was a layer of re-solidified S^o on the borehole annulus and that this layer was not easily removed. In addition, vibration of the drill stem pulverized the S^o making core recovery impossible.

Figure 3.1 Photograph of sonic drill casing coated in re-solidified S^o immediately after being removed from borehole.

The solid stem auger method was more successful, although no cores could be obtained using this method. The auger method was capable of producing both angled and vertical boreholes and could be drilled without the use of water. Care had to be taken to ensure that temperatures produced by the auger did not approach the S^o melting point. The temperature of the borehole was measured by lowering thermistor wire down the borehole after the augers were removed and the temperature of the augers was measured using an infrared measurement device. Consequently, the temperature of the advancing auger flight and borehole was monitored during drilling, initially after every 1.5 m of drilling. Once it was demonstrated that the auger temperature remained below 30 ^oC, drilling continued. There was no indication from field observations of the cuttings or augers that any melting occurred during drilling.

To ensure that there was a high probability of intersecting both vertical and horizontal fractures, both vertical and angled boreholes were drilled. Seven boreholes (4 vertical and 3 angled) were drilled in the S^o block using a solid stem auger owned and operated by Beck

Drilling and Environmental Services Ltd. during October 2008. The total vertical depth of each borehole was approximately 13 meters below the surface of the sulphur block (mbss). The angled boreholes were drilled at an angle of 45 degrees below the horizon. The diameter of all boreholes was 150 mm. The location of the boreholes (Figure 3.2) was chosen based on the following criteria:

- accessibility and maneuverability of the drill rig;
- ease of access to the top of the S^o block for vehicles and personnel, including access required in case of an emergency: and
- proximity to existing CMT gas ports for pressure measurement during cross-hole testing.

Gas testing of the new boreholes was completed in the summer of 2009. The open boreholes were sealed following drilling by filling the top of the surface of each borehole with crumpled up 6 mil polyethylene plastic to minimize precipitation from infiltrating into the block (Figure 3.3). A small square of 6 mil polyethylene plastic was then placed over the top of each borehole and secured to the block using roofing tar to further minimize the infiltration of precipitation into the boreholes and the short circuiting of atmospheric air into the block (Figure 3.3).

The solid stem auger technique produced a fine dust that coated the annulus of the borehole. It was envisioned that if this dust was not removed it could adversely impact gas testing as experienced by Bonstrom (2007). The S^o dust also prevented borehole video logging of the fractures. Consequently, a cleaning procedure was developed to remove the S^o dust from the side walls and bottom of each borehole. This procedure consisted of brushing the walls of each borehole with a plastic bristled chimney brush (Figure 3.4) followed by removal of the dust using an industrial vacuum truck at full suction (> 1.9×10^{-2} m^3 s^{-1}). The brush was repeatedly lowered and raised in each borehole until the resistance to brush movement decreased. Once the borehole had been cleaned to its maximum depth the vacuum hose (while running) was lowered slowly down the borehole. Compacted material, at the base of the hole, was removed by repeatedly raising the hose approximately one meter above the base of the hole and dropping it. Once the sound of material passing through the hose had stopped the hose was removed and the chimney brush was lowered to clean the base of the borehole and the loosened material removed with the vacuum.

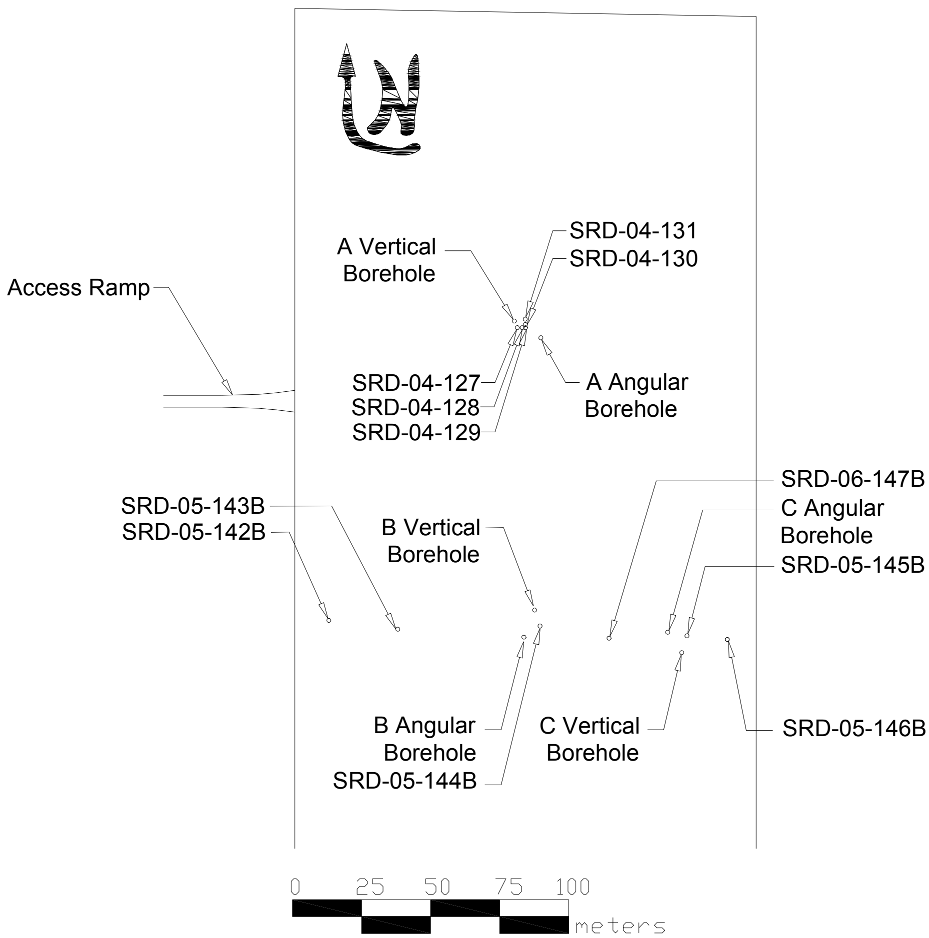

Figure 3.2 Layout of borehole and CMT monitoring locations in plan view. Image illustrates the position of the boreholes in relation to the CMTs that were used as monitoring locations.

Figure 3.3 Photograph of sealed borehole. Black material in photo is roofing tar used to seal the heavy plastic liner over the open portion of the borehole.

Figure 3.4 Photograph of chimney brush used to clean the borehole annulus of residual S^o dust. Image was taken at the surface of the C vertical borehole.

A single-hole gas test (procedure discussed in Section 3.5.3) was conducted following cleaning. The cleaning procedure was then repeated over the section of the borehole on which the test had been conducted and a second packer test was conducted maintaining nearly identical flow conditions to those used in the first test. The pressure response during testing was then evaluated to decide whether additional cleaning should be undertaken. It was decided that the cleaning procedure had been completed to an acceptable level once the pressure response at each respective flow rate changed by less than 10%. Once the optimal cleaning procedure had been determined it was conducted on the remaining boreholes.

3.4 Fracture Characterization

McKenna (2004a) and Bonstrom (2007) mapped block fractures using exposed surfaces on the block surface. These researchers recorded fracture frequency, fracture aperture, and general observations regarding fracture characteristics. McKenna (2004a) also conducted borehole video camera work to characterize the fractures within newly drilled boreholes. The present fracture characterization program was intended to supplement this work and further characterize the fracture spacing through core sampling and borehole imaging of the newly constructed boreholes. As the drilling method did not provide core samples, the only means of characterizing the fractures was through the use of a borehole camera.

A Geovision Jr.® (manufactured by Marks Products, Inc.) analog video camera was used to capture video on four of the six boreholes (B vertical, B angular, C vertical, and C angular) from September 30th to October 2nd, 2009. The end of a steel tape measure was attached near the head of the camera so that the depth of the fractures could be defined. Camera footage was monitored and recorded using a portable television equipped with a videocassette recorder. The camera was equipped with a tilt and pan function to allow rotation of the camera head horizontally and vertically. Observations made during the borehole imaging were recorded via a personal digital recorder and headset. The field recorded audio and video files were merged together using Final Cut Pro (2013 Apple Inc.) video editing software to provide a continuous visual record of the borehole. Although no direct measurements of fracture aperture could be determined from the borehole imaging, observations regarding the orientation, relative openness and fracture spacing were assessed. The orientation, fracture frequency, and the types of fractures (open versus seemingly closed fractures) were used to evaluate the results from the packer tests at the corresponding depths to determine if there was a relationship between these properties and the field measured conductivity. The video footage was also used to assess whether or not the fine S^o dust had been effectively removed from the block fractures after cleaning.

Video footage could not be obtained for the two remaining boreholes (A vertical and A angular) due to an emergency S^o pour which buried the holes shortly after the completion of the packer testing. Detailed review of the borehole video footage was completed for the B angular and C vertical boreholes only, due to time constraints.

3.5 Gas Pumping Tests

The following section describes the test methodology, types of equipment utilized, and the test procedures used for the single- and cross-hole pumping tests.

3.5.1 Pumping Test Setup

All of the down-hole gas testing was undertaken using a straddle packer. This type of test was determined to be the most suitable as it could be used within open boreholes and allowed the test geometry (i.e. length of intake and depth) to be adjusted for both vertical and angled holes. The use of packer systems is common in both hydraulic and gas pumping and injection tests in the field (Rasmussen et al., 1990, 1993; Guzman et al., 1996; Basset et al., 1997; Cook, 2000; Illman and Neuman, 2000, 2003).

A schematic of the straddle packer system used for this study is illustrated in Figure 3.5. The packers were manufactured by Vanderlans and Sons Inc. with a maximum inflation diameter of 0.18 m and inflation pressure of 553 kPa. The straddle packer system consisted of two 114.3 mm diameter rubber diaphragms (un-inflated length of 0.86 m) that could be inflated to isolate a specific interval in a borehole. A hollow steel pipe with an inner diameter of 25.4 mm running through the center of each packer allowed gas to be extracted from the isolated interval. Both of ends of the steel line were threaded so that various lengths of pipe could be inserted between the packers to modify the length of the test interval (0.37, 1.38, 2.39, and 2.90 m). A hollow steel line with an inner diameter of 6.35 mm running through the upper packer was used to inflate both the upper and lower packers. Vanderlans and Sons Inc. added a secondary line of similar diameter as a modification to the upper packer so that a pressure transducer could be connected at the surface of the block to measure the pressure response within the test interval.

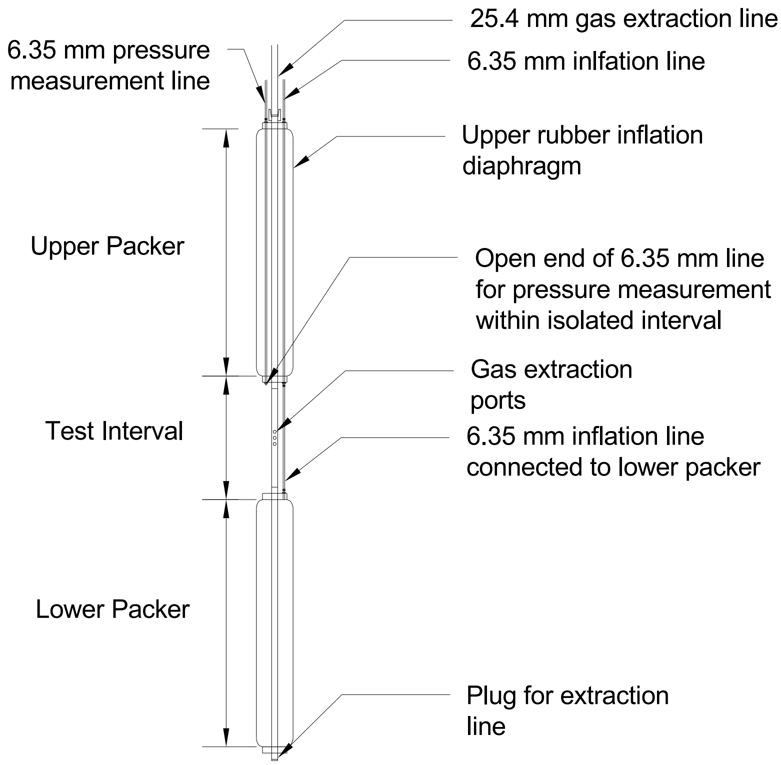

Figure 3.5 Schematic of packer string used for the gas pumping tests. Schematic is not to scale and is for illustration purposes only.

3.5.2 Packer Inflation, Leak Test, and Seal

The packer system was subjected to a leak test prior to field-testing. The packer was placed in a 150 mm PVC pipe and inflated until the backpressure reached approximately 345 kPa, after which the injection line was closed off isolating the pressurized air inside the packer. The packer was left inflated for several hours to determine if the packer system lost pressure as a result of leakage. This test was conducted before and after transporting the packer to the field. If a pressure drop was observed, each connection was checked using a diluted soap solution to identify poor connections or defective seals and the problem rectified.

The packers were inflated in the field using a tank of compressed nitrogen gas and a pressure regulator was used to ensure that the packers were not filled beyond capacity (553 kPa). A three-way valve was used to close the inflation line and to release the packer pressure quickly if necessary. A Dwyer dial type pressure gauge (range: 0-1500 kPa; accuracy: ± 0.5 % at full scale) was used to monitor the rate of inflation so that the packers were not filled too quickly resulting in damage to the packers. The gauge was also used to monitor the packer pressure during each test to ensure that a leak had not developed.

Two methods were used to ensure a proper seal between the packer and borehole annulus. A visual inspection using S^o dust was conducted to assess the seal between the upper packer and the borehole (Figure 3.6). During cleaning of the borehole, it was noticed that even with the vacuum located at the bottom of the borehole that S^o dust from the surface would be drawn into the borehole. Therefore, during testing a small amount of fine S^o dust was added near the opening of the borehole to see if it was drawn towards the packer. The lower packer seal was evaluated by measuring the air-pressure below the packer using a Solinst levelogger (model: 3001; pressure range/accuracy: 0 to 88 kPa/± 0.5 kPa: temperature range/accuracy: -20 to 80 ^oC/± 0.05 ^oC) attached to the steel pipe. The levelogger was set to record the pressure every 15 s and was initiated prior to lowering the packer assembly into the borehole. The results were reviewed following completion of the testing (test duration: < 5 to 90 minutes). Measurements recorded using the levelogger were manually compensated (relative) to barometric pressure measured using a Solinst barologger (model: 3001; accuracy: ± 0.01 kPa) on the surface of the block every 15 minutes. A proper seal between the packer and the borehole wall was obtained when the magnitude of the pressure measured below the deepest packer (lower pressure; P_L) was between the barometric and test interval pressure.

Figure 3.6 Photograph of the upper packer inflated in a vertical borehole. The borehole wall (S^o) can be observed on the left hand side of the image. On the right hand side of the image the harness used to attach the packer string to the steel cables can be seen.

3.5.3 Gas Pumping Test Setup

Various methods of creating sufficient suction for the pumping tests were evaluated; however, based on initial estimates of K of the S^o block, the only feasible method identified was the use of an industrial vacuum truck (specifications unknown). A transparent, polyethylene reinforced, rubber hose (inner diameter of 25.4 mm) was used to connect the vacuum truck supply line to the steel extraction pipe on the packer assembly. The transparency of the hose allowed any removal of dust or water to be observed during testing. During the initial tests, large fluctuations in the flow rate (on the order of 9.4 x 10^{-3} m^3 s^{-1}) were observed as a result of oscillations in the pump on the vacuum truck when the truck was not running at full capacity. To reduce these fluctuations and to more easily control the flow rate, a tee was installed immediately upstream of the flow meter with an Aqua-Dynamic gate valve installed on the portion of the tee perpendicular to the direction of flow (Figure 3.7). The truck could then be run at full capacity and the flow rate controlled by opening or closing the gate valve (allowing entrance of atmospheric air). This in turn reduced the number and magnitude of variations in the flow rate to negligible amounts (< 2.4 x 10^{-4} $m^3 s^{-1}$). Air flow rates were monitored using an Omega OEM-Style Acrylic Rotameter (model: FL7411; accuracy: 4 %) capable of measuring flow rates in the range of 1.9 x 10^{-3} to 1.9 x 10^{-2} $m^3 s^{-1}$ with a pressure drop of 2.4 kPa at full capacity.

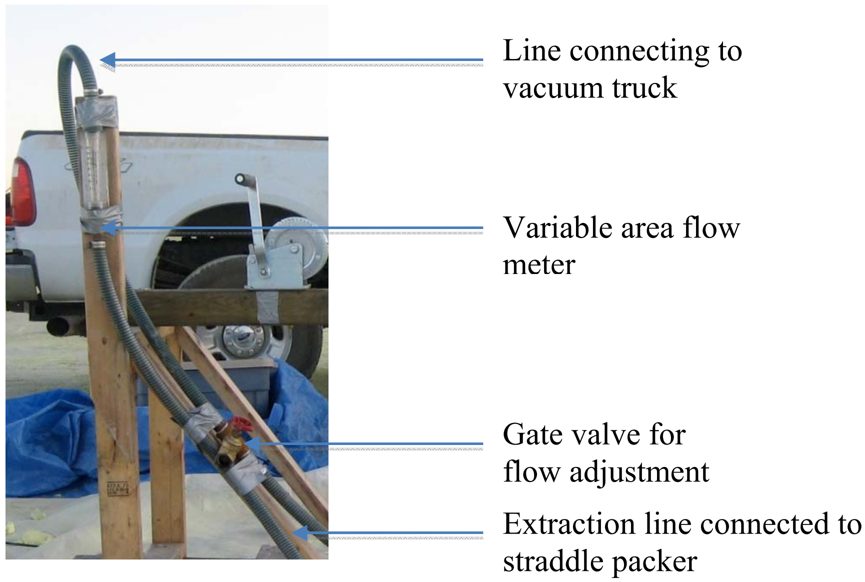

Figure 3.7 Photograph of flow regulation setup. Image shows location of gate valve and flow meter in relation to vacuum truck and extraction lines.

The pressure response in the test interval (Figure 3.8) was measured using an Omega pressure transducer (model: PX209-30VACI; accuracy: 0.25 %) with an operating range of zero to full vacuum (gauge pressure). The transducer output signal (mA) was recorded using a Campbell Scientific CR10X data logger that converted the output signal to mV. A laptop computer, connected to the data logger, was used to observe the output signal after conversion to pressure. Conversion of the output signal to gauge pressure was done using the factory-supplied calibration programmed into a Microsoft Excel (2013 Microsoft Corporation) spreadsheet. To measure the temperature and RH at which the gas was being extracted, a MAXIM hygrochron (model: 1923S; accuracy: ± 5 %RH) was placed within the test interval. Similar to the levelogger used to monitor seal efficiency, the hygrochron (ibutton) monitoring device was set to record every 15 s and was initiated prior to lowering the packer assembly down the hole and the data were downloaded after completion of the test.

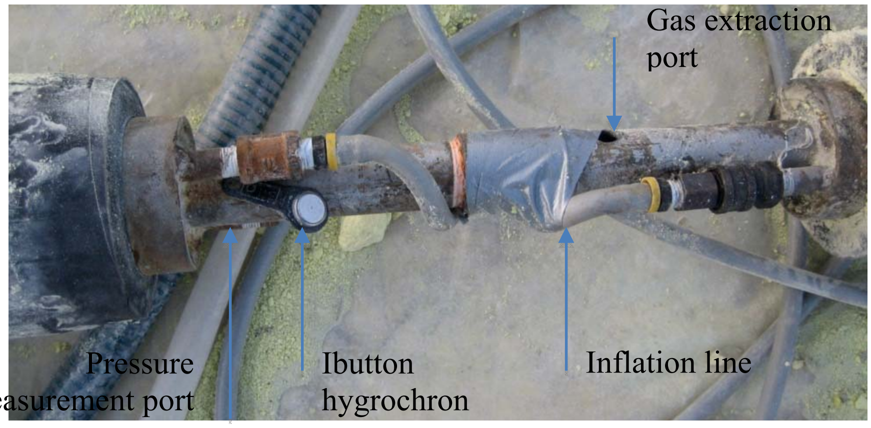

Figure 3.8 Photograph of test interval. The test interval is the area between the rubber diaphragms. Image shows location of pressure measurement port (only slightly visible), ibutton hygrochron (used for temperature and RH measurement), inflation line connecting the packers, and the gas extraction port.

The packer was suspended in the boreholes using a hand winch supported on a wooden frame straddling the borehole (Figure 3.9). The wooden suspension frame was designed to lower the packer into both the vertical and angled boreholes using pulleys. A specially designed coupling was constructed so that a steel cable could be connected to the upper packer. A cloth measuring tape was attached directly above the upper packer to measure the test depth.

3.5.4 Single- and Cross-hole Gas Pumping Test Procedures

Gas straddle-packer tests (n = 59) were conducted on the Phase 1 S^o blocks between the 9th and 24th of October 2009. Two types of gas tests were conducted: single- and cross-hole pumping tests using multiple flow rates (4.6×10^{-3} to 1.9×10^{-2} $m^3\ s^{-1}$). The procedure for the gas pump testing was based on similar tests conducted by others (Rasmussen et al., 1990, 1993; Guzman et al., 1996; Basset et al., 1997; Cook, 2000; Illman and Neuman, 2000, 2003; Edwards and Jones, 1994; Massmann and Madden, 1994; Baehr et al., 1989; McWhorter, 1990).

Figure 3.9 Photograph of straddle packer being removed from angled borehole. The wooden structure on the right hand side of the image was placed over the borehole and used to suspend the packer within the borehole. Only the upper pulley was used for the vertical borehole whereas both pulleys were used to align the packer within angled boreholes.

Multiple flow rates were used because the interpretation of multiple tests over a range of flow rates in a single location have been used to identify effects such as non-linearity, fracture clogging, fracturing widening, and other anomalies (Lecain, 1995). The applied flow rate was maintained as low as physically possible during testing to mitigate the effects of turbulent flow and gas expansion. To reduce the likelihood of fracture clogging it was decided that pumping gas out of the borehole would be preferable to injecting it into the borehole. Pumping would continue to extract any remaining S^o dust during the test rather than forcing it into fractures or pores. It also ensures that no foreign gas of differing RH, temperature, or oxygen content is injected into the block. Figure 3.10 illustrates the basic gas pumping test setup used for both the single- and cross-hole tests.

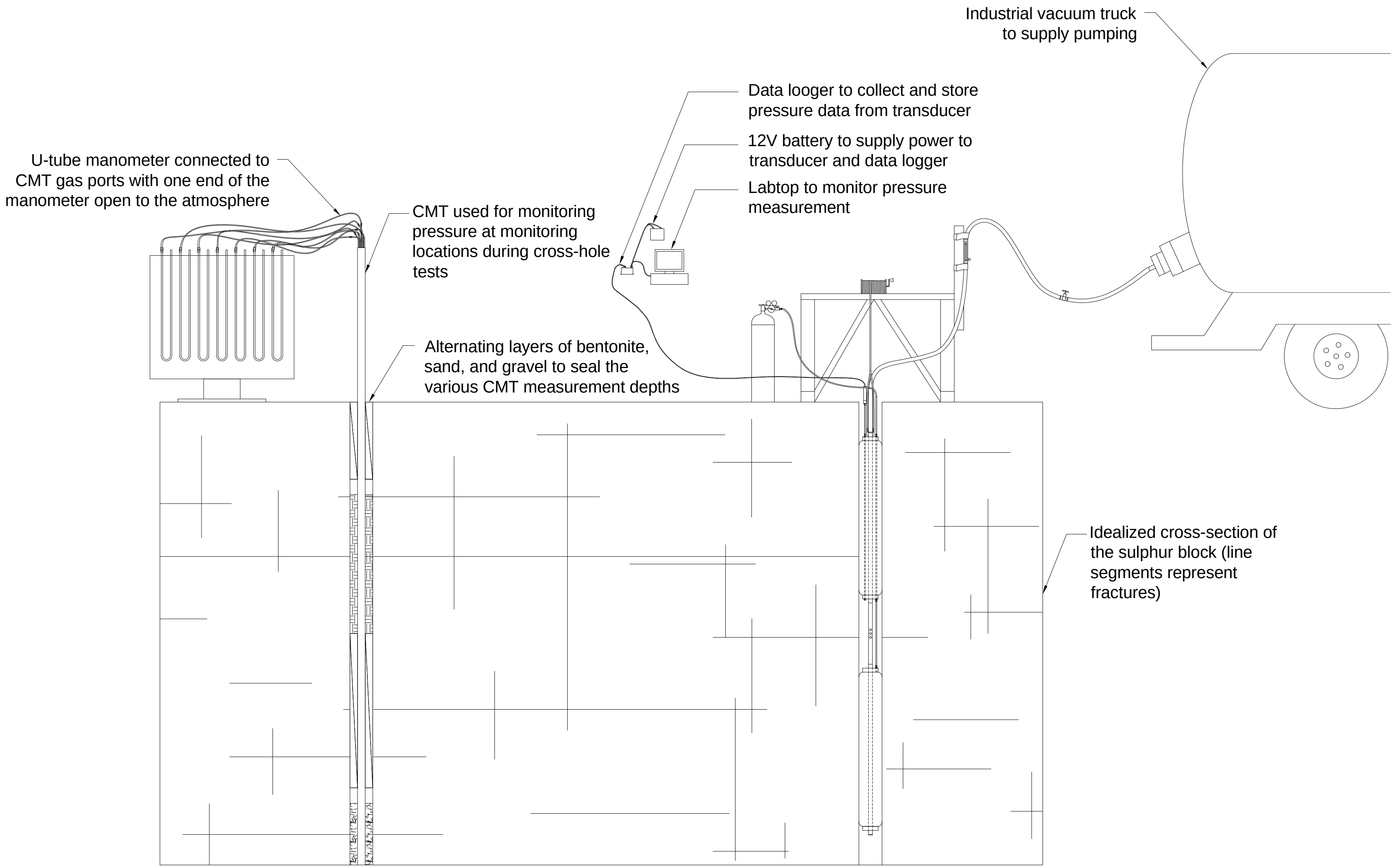

Figure 3.10 Schematic of gas pumping test setup for a conceptual image of block and CMT gas port installations. Image illustrates setup of the pump system, straddle packer assembly, pressure measurement and monitoring devices, and U-tube manometers. Drawing is not to scale.

The single- and cross-hole tests were conducted simultaneously. The only difference between the two tests was that for the cross-hole tests U-tube water manometers (resolution: 0.25 mm) were used to measure the pressure at the monitoring locations. A 1.38 m test interval length was used for all of the tests with the exception of the scale tests (discussed in Section 4.3.8). The procedure for the gas pumping test was as follows:

1) Initialized all data acquisition equipment and software including:
   - datalogger and pressure transducer for pressure measurement and monitoring;
   - ibutton for temperature and relative humidity measurement;
   - levelogger for leak by pressure (P_L) measurement; and
   - Excel spreadsheet for real time pressure measurement and observation.
2) Fastened devices to the appropriate locations including:
   - ibutton to steel pipe in test interval; and
   - levelogger to steel section below deepest packer.
3) Connected all lines to the packer assembly including:
   - gas extraction line to vacuum truck;
   - pressure transducer to measurement port;
   - packer inflation lines to compressed tank;
   - tape measure to top of packer; and
   - steel cables to support rings on coupling of upper packer.
4) Lowered packer to desired depth;
5) Initiated vacuum system on truck to build up vacuum;
6) Adjusted regulator on compressed nitrogen tank for packer inflation;
7) Recorded initial manometer readings at monitoring locations (cross-hole test)

8) Opened the valve on vacuum truck while at maximum vacuum to attempt to remove any water from the system (gate valve for flow regulation was closed at this time);

9) Opened the gate valve until a noticeable pressure response could barely be observed in the test interval after a steady-state pressure response had been achieved at maximum vacuum;

10) Measured the pressure in the test interval and the corresponding flow rate after achieving steady-state flow conditions. Recorded pressure at the monitoring locations (cross-hole test);

11) Repeated step 10 after closing gate valve to increase the pressure in the test interval. When possible this was done three times until three successive measurements of pressure had been made at increasing flow rates. After application of three increasing flow rates (1-2-3), the flow was reduced to similar magnitudes used on the ascending portion of the test (2-1) for a total of five flow rates. The first and fifth test (1 and 5) and the second and fourth tests (2 and 4) should be for nearly identical flow rates with the third flow rate being the maximum (3);

12) Stopped the vacuum and released the pressure in the packers; and

13) Lowered the packer by the length of the test interval and repeated steps 1 to 13.

This procedure was repeated for each of the boreholes starting at a depth as close to the surface of the S^o block as possible. In some instances, the packer had to be lowered 0.15 to 0.30 m below the surface of the block in order to obtain a sufficient seal as the top of the borehole was damaged. The deepest test was not conducted at the regular test interval, rather the packer was lowered until the packer string reached the bottom of the borehole. The test depths for each test series and the corresponding interval lengths are summarized in Appendix A.

Existing gas sampling ports were used as monitoring locations to observe the pressure response at various distances from the test location (distances of 2.7 to 50.3 m). These gas sampling ports were installed in 2004, 2005, and 2006 (Birkham et al., 2010b). The gas sampling ports were constructed of a single piece of CMT (material; outside diameter 0.043 m) containing seven individual sample channels. In each individual sample channel a small cut (area of ~0.0001 m^2) was made at regular intervals (typically 2 m) along the length of the CMT (material). Each CMT was then installed vertically in separate boreholes. Alternating layers of bentonite and sand/pea gravel were then installed between the annulus of the borehole and the CMT to isolate specific sampling depths. The open intervals (cuts in the individual channels of the CMT [material]) occur over depths of approximately 0.5-15 m below the surface of the S^o block. Detailed construction information can be found in Birkham et al. (2010b).

The location of the boreholes in relation to the CMT monitoring locations is illustrated in Figures 3.11 through 3.13. Pressure measurements at the monitoring locations were made using a series of U-tube manometers (Figure 3.14). For the A series test locations two manometers were installed with three way switches such that one manometer could be used to measure the pressure response of two adjacent CMTs. For both the B and C series tests, a single manometer was connected to each CMT. For each applied flow rate, the pressure at each monitoring location was recorded once steady-state conditions were achieved.

It is commonly stated in the literature that that there is a minimum time for which a test must be run to obtain steady-state flow conditions. Although the time will vary based on site-specific conditions and media, Guzman et al. (1996) indicates that each test should be continued until the change in pressure is below a specified minimum value (Guzman et al., 1996). However, in this study it was observed that the pressure response in the test interval and at the monitoring locations was attained almost instantaneously and did not appear to change with time. To ensure that steady-state conditions were achieved nearly instantaneously, the 230909-B-Vert-7 test series was continued for approximately 1.5 hours. For this test, after completing the standard test procedure (five flow rates), the fifth flow rate was maintained for approximately one hour. The pressure response in the test interval and at the monitoring locations was monitored approximately every ten minutes.

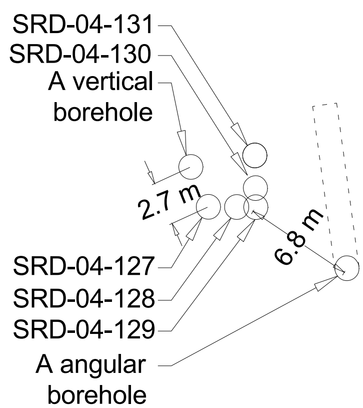

Figure 3.11 Schematic of borehole layout for the A series boreholes. For clarity only the radial distance between the boreholes and the closest CMTs are shown in the figure. Dashed lines indicate the orientation of the angled borehole.

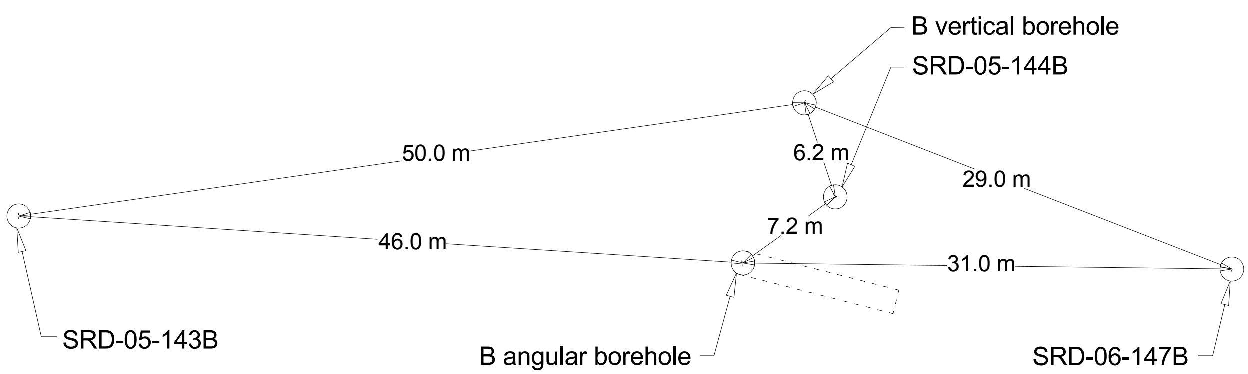

Figure 3.12 Schematic of borehole layout for the B series boreholes. Radial distances between boreholes and CMTs are shown on the figure. Dashed lines indicate the orientation of the angled borehole.

3.6 Interpretative Methodology for the Determination of Gas Conductivity

One of the primary objectives of the current study was to determine the K of the above ground S^o blocks. The reason for using gas tests was to avoid a number of complexities associated with typical hydraulic (water) tests. The data from the pumping tests was used to determine the K_g of the block from which K_l could be determined. The following section will describe the analytical methods used to evaluate the pumping test data and the procedure used to determine the resulting K_l. In addition to the use of analytical methods, numerical modeling was used to assess the pumping test data.

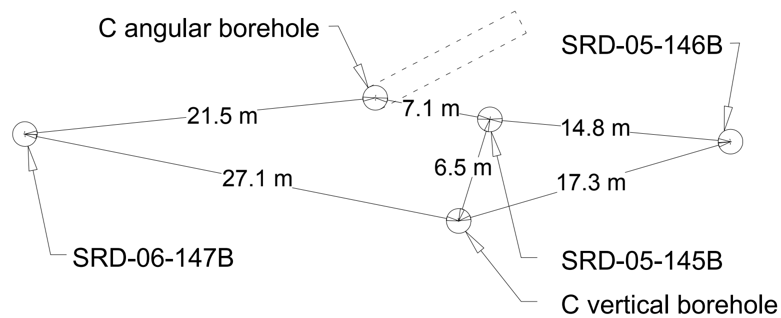

Figure 3.13 Schematic of borehole layout for the C series boreholes. Radial distances between boreholes and CMTs are shown on the figure. Dashed lines indicate the orientation of the angled borehole.

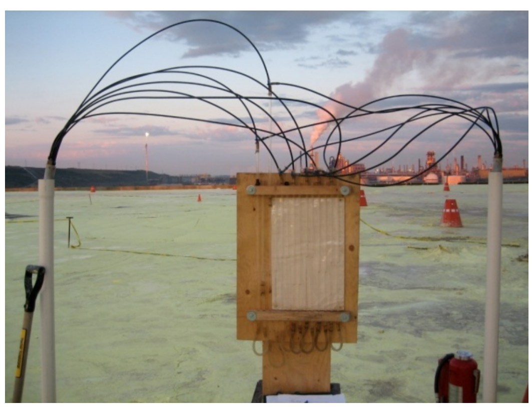

Figure 3.14 Photograph of U-tube manometer used for pressure measurement at monitoring locations. An example of a U-tube manometer setup for the A series tests where one manometer is used to monitor the pressure of two CMTs using three way luer locks.

3.6.1 Analytical Estimation of the Gas Conductivity

Both the single- and cross-hole K_g values were calculated directly using analytical solutions for the determination of k. For the single-hole pumping test data k was calculated using the analytical solution of Lecain (1998):

$$k = \frac{P_{sc} Q_{sc} \mu \ln\left(\frac{L_T}{2r_w} + \sqrt{1 + \left(\frac{L_T}{2r_w} \right)^2} \right) T}{\pi L_T \left(P_{ss}^2 - P_o^2 \right) T_{sc}} \qquad [3.1]$$

where P_{sc} (Pa) and Q_{sc} ($m^3\ s^{-1}$) are the pressure and flow rate under standard operating conditions, respectively, μ is the dynamic viscosity (Pa s), ln is the natural logarithm, r_w is the borehole radius (m), L_T is the length of the test interval length (m), T is the absolute air temperature (K), P_{ss} is the pressure at steady-state (Pa), P_o is the initial pressure (Pa), and T_{sc} is the absolute temperature at standard conditions (K).

The intrinsic gas permeability (k_g) was determined from the cross-hole pumping test data using the following equation presented by Illman (2006):

$$k = \frac{Q\mu}{4\pi R_c \Delta p} \qquad [3.2]$$

where Q is the flow rate ($m^3\ s^{-1}$), μ is the dynamic viscosity (Pa s), R_c is the distance between the centroids of the test and monitoring intervals (m), and Δp is the increase in pressure in the monitoring interval (Pa). Both Equation 3.1 and 3.2 assume the lateral boundary is infinitely far from the test location.

Equations 3.1 and 3.2 were originally developed by Hvorslev (1951) and Hsieh and Neuman (1985), respectively, for the analysis of liquid flow. The underlying theory for the original form of Equations 3.1 (Lecain, 1995) and 3.2 (Illman and Neuman, 2000) were adapted by squaring the pressure term to account for the non-linearity of the pressure loss to flow relationship of gas flow. However, Illman and Neuman (2000) illustrated that the use of either the pressure or pressure squared term resulted in negligible differences in the estimation of k. Therefore, Illman (2006) adapted the use of a linear pressure term in Equation 3.2.

The use of Equation 3.2 required the assumption that the test and monitoring intervals can both be treated as points (Hsieh and Neuman, 1985). Hsieh and Neuman (1985) provide two variables that could be used to determine if the injection and monitoring intervals can be treated as points: α_1 and β_1, respectively. Each variable takes into consideration the ratio of the length of the monitoring interval (L, m) and R_c of the injection and monitoring intervals. Hsieh and Neuman (1985) illustrate that as α_1 $2R_c/L$ approaches a value of 5 or greater, the difference between treating the injection interval as a point or a line of finite length becomes negligible. Using the smallest R_c (3.7 m) and the standard test interval length (1.38 m), the resulting value for α_1 was calculated to be 5.4. Because α_1 was greater than 5 for the smallest value of R_c it was decided that the injection (pumping in this case) interval could be treated as a point. A value of five or greater for β_1 was highlighted by Hsieh and Neuman (1985) to be the limit for whether or not the monitoring interval could be treated as a point for analyses purposes. Although, the calculation of β_1 required information regarding the direction of the monitoring interval with respect to the injection interval, this aspect of the calculation was considered negligible in comparison to the $2R_c/L$ portion of the calculation, which was large due to the small length of the monitoring interval. If the cut (~0.0001 m^2) made in the CMT was assumed to be square the resulting length would be 0.01 m and would result in a value of $2R_c/L$ (using the smallest R_c distance, 3.7 m) of 740 which was much greater than 5. Therefore, it was determined that both the injection and monitoring intervals could be treated as points. Hsieh and Neuman (1985) stated that if pumping rather than injection tests were conducted the value of Δp would be the decrease in pressure in the monitoring interval rather than a head increase. The distance, R_c, was computed from the field measured distances between the boreholes and CMTs. The orientation of the angled boreholes was estimated from measurements of the borehole azimuths in the field.

3.6.2 Axisymetric Numerical Modeling Estimation of the Gas Conductivity

Two commercial finite element software programs SEEP/W (portion of the Geostudio 2007 modeling suite) and SEEP3D, both produced by Geo-Slope International Ltd., were used to analyze the single- and cross-hole test data. SEEP/W was used to analyze the single- and cross-hole tests completed in vertical boreholes that were located sufficiently far away from the block boundary that an axisymetric model could be assumed valid. A sensitivity analysis was conducted using the numerical modeling software (data not presented) to determine the minimum distance for which boundary effects were negligible. A three dimensional model was required to simulate the pumping tests conducted in the angled boreholes or those boreholes located near to the block boundary. For these cases the three-dimensional flow model, SEEP3D, was used.

SEEP/W and SEEP3D are typically used to simulate water flow; however, water flow models may be used to simulate gas flow if certain assumptions can be satisfied (Massmann, 1989). Consistent with Equations 3.1 and 3.2, Massmann (1989) suggested that a water flow model, albeit accounting for pressure loss with increasing flow linearly, will produce reasonable estimates of k if the change in pressure is limited to 10 to 20 % relative to atmospheric pressure. The flow rates and hence the corresponding absolute pressures (84.9 to 101.5 kPa), applied during field tests were maintained as low as possible in an attempt to validate such assumptions. The greatest change in pressure in the test interval relative to atmospheric pressure was approximately 15 %.

3.6.2.1 Axisymmetric Model

The pumping tests undertaken in the A and B (vertical) boreholes were simulated using a steady-state, axisymmetric model. A sensitivity analysis (data not shown) undertaken using field calibrated properties (K_g values in the range of 1 x 10^{-4} m s^{-1} and anisotropy ratios [A_{gr}: ratio of vertical and horizontal cross-hole conductivity values] smaller than approximately 0.25) illustrated that when the block boundary was < 50 m from the test location the presence of this constant head boundary would influence the model simulations. Because the C (vertical) series tests were approximately 30 m from the block edge, they were not analyzed using the axisymetric model.

The nearly instantaneous pressure change and steady pressure readings in all of the monitoring intervals over the duration of the tests demonstrated that steady-state conditions were applicable. Birkham et al. (2011) measured a mean residual volumetric water content within the fractures of approximately 0.6 % compared to a mean fracture porosity of 1.4 % measured by Bonstrom (2007). This suggests that the largest fractures within the block are drained and available for gas flow. Since these open fractures were assumed to dominate the K_g of the block it was assumed that the field measured K_g would provide a reasonable estimate of K_l of an equivalent fully saturated block.

3.6.2.2 Mesh Design

The axisymetric model domain extended from the borehole to the nearest block edge and from the surface of the S^o block to the base of the block (16 m). Bonstrom (2007) used a similar domain for the analysis of hydraulic packer tests.

A sensitivity analysis was conducted to determine the optimum mesh size needed to produce smooth flow contours while maintaining computational efficiency. The finite element mesh was refined adjacent to the pump interval and was increased with distance from the test interval. The smallest element size for each model was approximately 0.05 m and the largest was approximately 0.5 m. Each model varied slightly in design due to changes in the test depth and the depths of the monitoring intervals. Therefore, no consistent number of elements was used for all of the models. The mean number of elements used was approximately 12,000. The test interval and borehole dimensions were assigned based on field conditions. The radius of the borehole annulus was 0.0762 m in the model.

3.6.2.3 Material Properties and Boundary Conditions

In steady-state flow models, the head distribution within the domain is controlled only by the magnitude of the flow rate relative to the K of the materials. In the model simulations, the material properties and pumping rate were assigned relative values. This approach allowed a single simulation to be run for each test geometry. The results for individual pumping rates were then scaled from this single simulation to determine the properties that best simulated the field observations.

The borehole annulus and equipment installed in the borehole (e.g. test interval, packer interval, and open borehole) were not assigned material properties, rather a series of boundary conditions were applied along the borehole annulus to simulate these features. The test interval was assigned a relative flux boundary condition of -1 m^3 s^{-1} m^{-2} (a negative flux signifying fluid movement out of the model). The model flux was calculated by dividing the measured flow rate by the surface area of the borehole. This calculation proved necessary when scaling the model data from relative to actual conditions. The packer intervals were assigned as no flow boundaries. The open borehole above the packers was assigned the same total head as the surface and sides of the block as it was assumed that that borehole did not provide any restriction to gas flow along the annulus. The area below the packer was assigned a no flux boundary as it was assumed that short-circuiting of gas through the open borehole would not have an appreciable effect on the results. To verify this assumption several models were constructed with the open portion of the borehole, below the packers, as a material with significantly greater K. K values for the open borehole ranged from 10 to 100,000 m s^{-1}. The modeling results illustrated that treating the open borehole as either a no flow boundary or a material of significantly greater K produced similar results (data not shown).

The sides and surface of the block were assigned a total head boundary condition equal to the height of the block such that when no pumping occurred there would be no difference in head or flow through the block. The surface of the block was set at an elevation of 0 mbss and the maximum depth of the block was 16 m. Therefore, the total head boundary conditions applied to the sides and surface was a total head (of gas) of 0 m.

The block was assigned a saturated K of 1 m s^{-1}. In the case of the single-hole tests it was assumed that the block was transversely isotropic with respect to the K since there was no information from these tests to suggest the presence of anisotropic conditions (discussed in Section 4.3.4.3). This assumption also allowed the results from the numerical model to be compared to analytical solutions to verify the numerical methodology. In the simulation of the cross-hole test data, a range of anisotropic K ratios were used to determine a best-fit to field measured properties. Examples of the SEEP/W model domain and total head contours are presented in Figures 3.15 and 3.16, respectively.

3.6.2.4 Conversion of Model and Field Observations

The pressure head drawdown within the test interval was treated as a linear function of both the applied pumping rate and the K_g of the S^o block. For the single-hole tests the simulated drawdown pressure at the well was first scaled by the ratio of the applied flow rate to the simulated flow rate based on the measured flow rate after conversion to an equivalent flux rate based on the circumference of the borehole. The K was then adjusted until a best-fit was achieved between the simulated pressure and the field-measured pressure in the test interval. A similar procedure was used in the cross-hole tests.

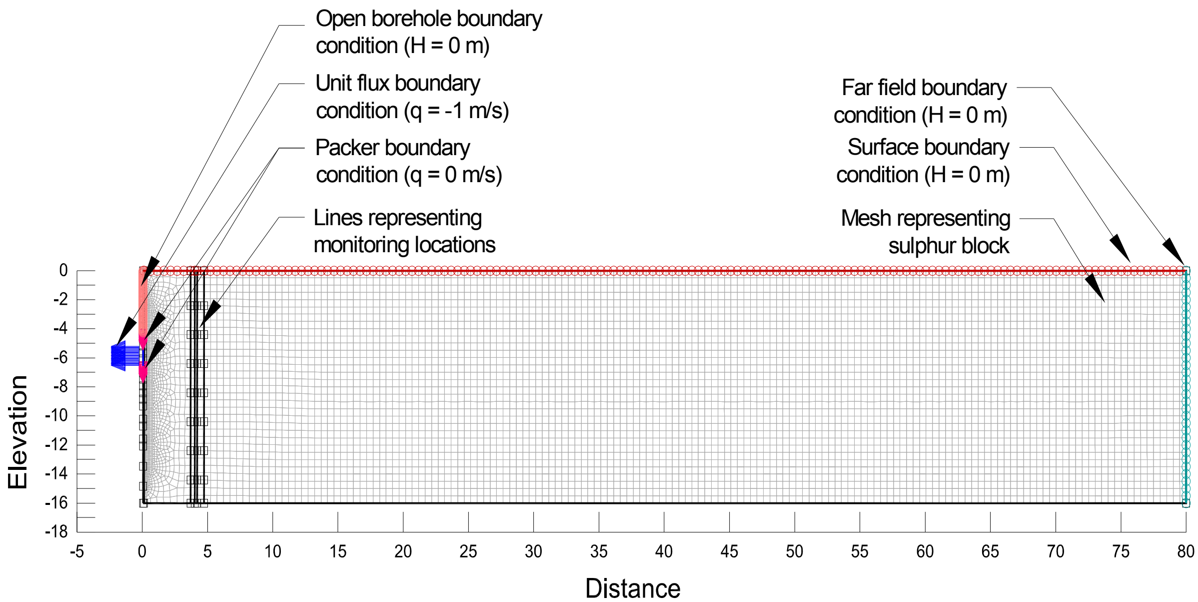

Figure 3.15 Snapshot of Seep/W model construction for the A series test 140909-A-Vert-4. Boundary conditions have been labeled on the figure. H and q represent the total head and unit flux, respectively.

In the case of the cross-hole tests the pressure response at the monitoring intervals was used as the calibration point rather than the pressure measured in the test interval. For the cross-hole simulations, both the anisotropy ratio and the conductivity were adjusted to achieve a best-fit between the simulated pressure and the field-measured pressure at the monitoring locations. The best-fit between the simulated and measured pressure response was determined by visual inspection and the sum of least squares method. The visual inspection was used to verify the results of the sum of least squares method.

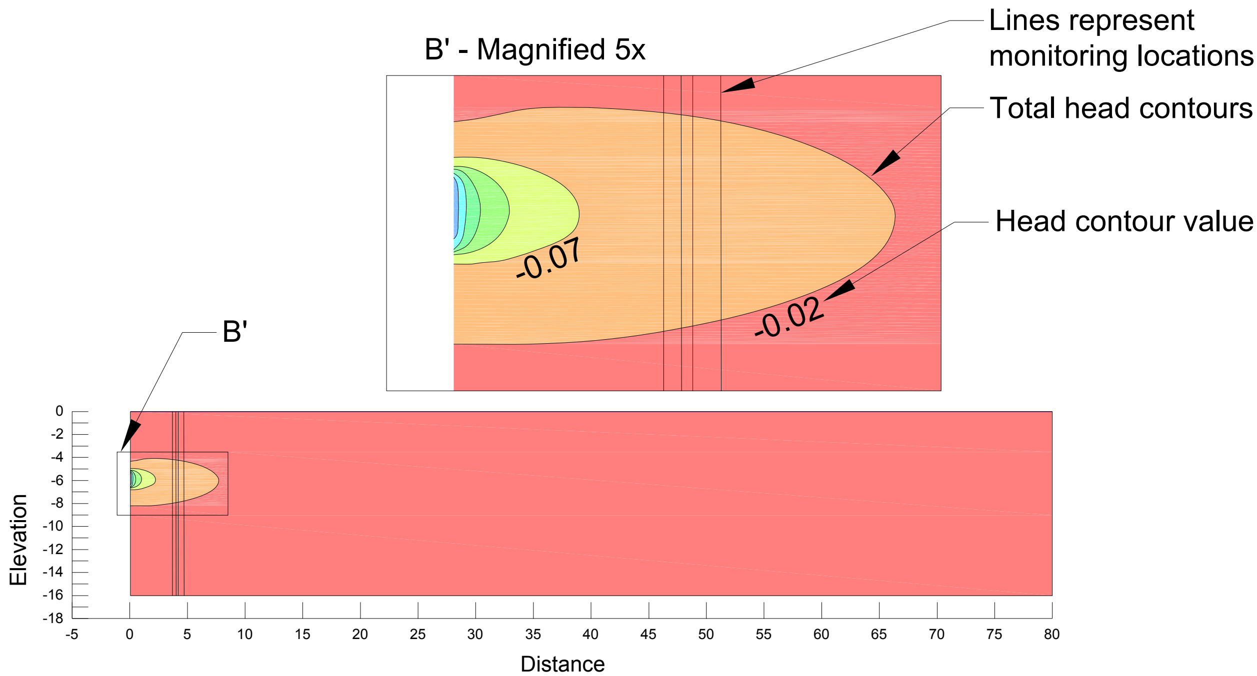

Figure 3.16 Image of SEEP/W total head contours for the A series test140909-A-Vert-4 (A_{gr} = 0.075). Boundary conditions and mesh have been removed from the image for clarity. Select total head contours have been labeled in the magnified image and can be identified by a dark line and change in color and are in increments of 0.05. The contours represent the drawdown for relative model conditions (i.e. K = 1 m s^{-1}).

3.6.3 Three Dimensional Numerical Modeling Estimation of the Gas Conductivity

SEEP3D is a three-dimensional finite element program that simulates water flow through saturated or unsaturated soil. The three dimensional analyses was required to simulate the C vertical series tests due to the proximity to the block edge. In addition, the geometry of the angled boreholes could not be represented using an axisymetric model in SEEP/W whereas the more complex geometry could be constructed in SEEP3D.

3.6.3.1 Mesh Design

The SEEP3D mesh was constructed using a similar methodology to SEEP/W. The shortest distance between the test location and the block boundary was assigned as the smallest dimension in the model. The second horizontal dimension was determined based on a sensitivity analysis and was defined as the minimum distance that would not affect the results. The true distance for the second horizontal direction could not be used because this required a very large number of elements. Once the number of elements exceeded approximately 300,000, the simulation could not be solved within a reasonable amount of time. The number and size of elements in vicinity of the test interval and adjacent locations were adjusted in an iterative manner while trying to ensure that the total number of elements within the model was not excessive. The mean element size in the vicinity of the test interval was 0.25 m. In all simulations an attempt was made to not increase the size of two adjacent elements by more than a factor of two; however, based on the constraint of a total of 300,000 elements, this could not be satisfied in all simulations.

A sensitivity analysis was conducted to determine if any benefit could be gained by increasing the number of elements above 300,000 (Figure 3.17). The sensitivity analysis was conducted on the model used in the analysis of test 220909-B-Ang-6. After completing the initial simulation, the mesh was refined in the vicinity of the pumping test location. After each simulation was complete, the number of elements was increased. Once the number of elements exceeded approximately 350,000, it was observed that the model would not converge within 2 hours. For example, when the number of elements for the 220909-B-Ang-6 model was increased to 467,262 elements, the model took approximately one week to solve on a HP Pavillion desktop computer with a 1.86 GHz processor and 3.4 GBs of RAM. As can be seen in Figure 3.17, once the total number of elements exceeded approximately 280,000, no significant changes could be identified in the simulated results.

3.6.3.2 Material Properties and Boundary Conditions

Similar material properties and boundary conditions to those used in the SEEP/W models were assigned in the SEEP3D models. The only difference was the way the boundary conditions were constructed/applied in the two software packages. Relative material properties and flow rates were also used for the SEEP3D models. An example of the SEEP3D model construction and total head contours can be seen below in Figures 3.18 and 3.19, respectively. The irregular shape of the total head contours in Figure 3.19 is due to the geometry of the angled borehole.

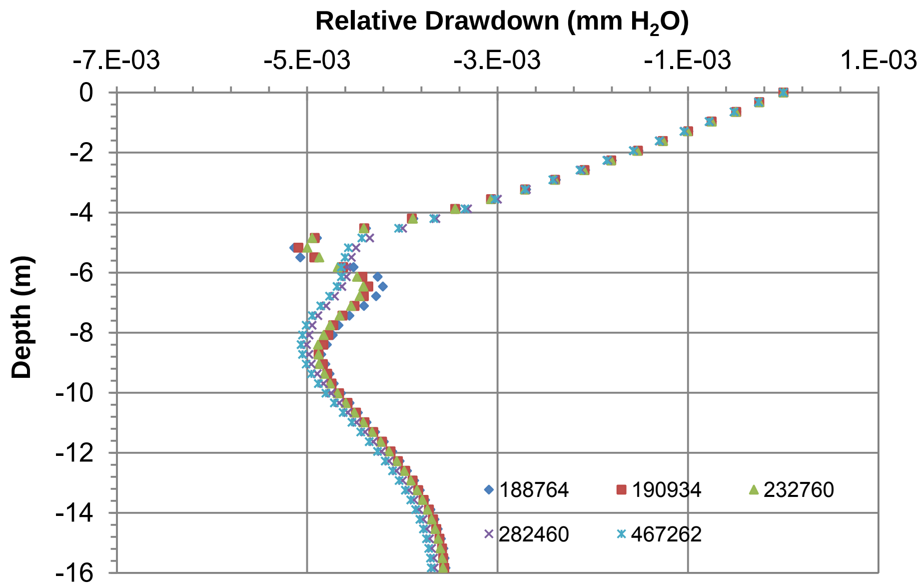

Figure 3.17 Relative drawdown with depth below the surface of the S° block for the B series test 220909-B-Ang-6 test series. The SEEP3D model for this test series was run several times each with a different total number of elements to illustrate the effects that mesh refinement had on the results. The legend IDs correspond to the total number of elements used in the SEEP3D models.

3.6.3.3 Conversion from Relative Model Properties to Field Conditions

The borehole could not be constructed with a circular annulus in SEEP3D but rather was represented by a series of parallelepiped elements with a width equal to the borehole radius. The surface area of the parallelepiped was used to determine the flux from the measured flow rate. SEEP3D also allows a third dimension of anisotropy to be used in the simulation. However, it was assumed in this study that the K was the same in all directions within a horizontal plane. Therefore, only the ratio of the vertical to horizontal conductivity was adjusted, similar to the method used in the axisymmetric SEEP/W model. With the exception of the flux, the methodology used to scale the simulations to field measured properties was identical to that used in SEEP/W.

The SEEP3D model construction/analytical methodology was verified by simulating one of the B vertical series tests previously analyzed using SEEP/W. No significant difference was noted between the results of the two simulations (data not presented).

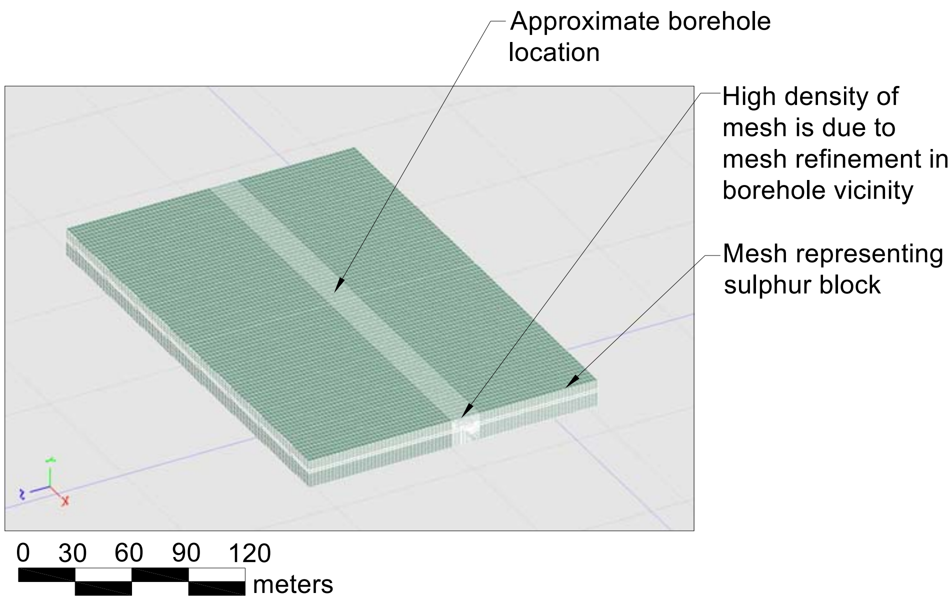

Figure 3.18 Image of SEEP3D model construction for the B series test 220909-B-Ang-6 illustrating the general mesh design.

3.6.4 Conversion Between the Intrinsic Permeability and Conductivity

Both k and conductivity are often used to describe the fluid resistance of a medium. The difference between the two is that k is used to define the resistance of the medium independent of a specific fluid. Contrastingly, the conductivity depends on both the resistance of the medium and the properties of the permeating fluid. Therefore, it was possible to determine the resulting conductivity values for the k_g values from Equations 3.1 and 3.2 using the relationship between k and fluid conductivity (Bloomfield and Williams, 1995):

$$K_g = k\left(\frac{\rho_g g}{\mu_g}\right)$$ [3.3]

where μ_g and ρ_g are the dynamic viscosity (Pa s) and density of the gas (kg m^{-3}), respectively. Because k can be used to describe the resistance of a medium independent of the permeating fluid, it was also used to determine the resulting K_l values from the field measured K_g values.

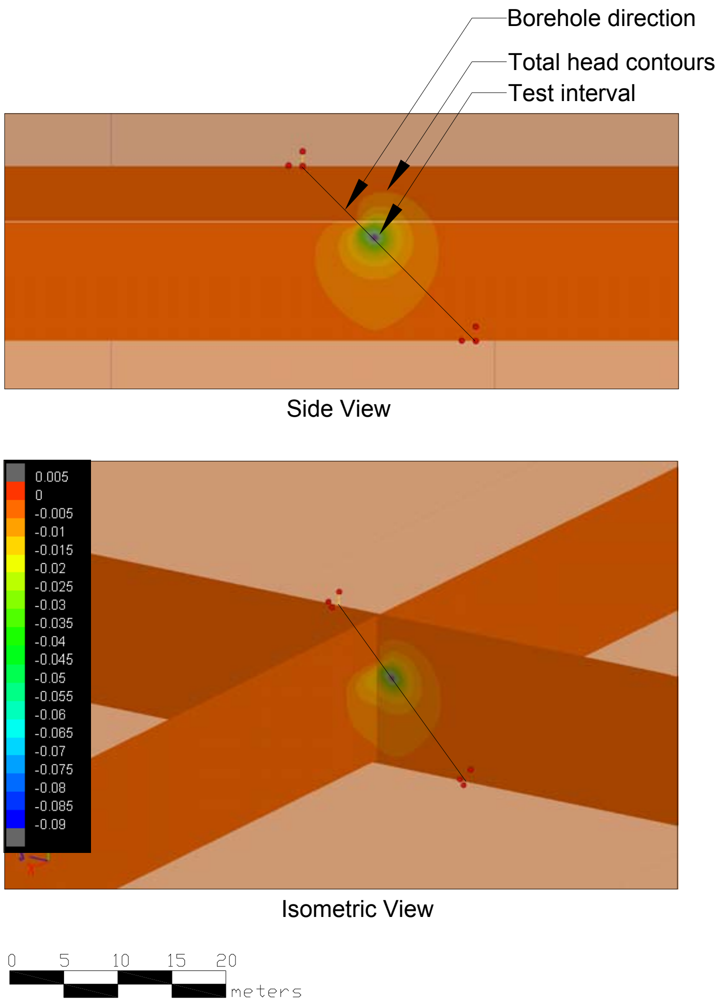

Figure 3.19 Image of total head contours for the B series test 220909-B-Ang-6. Two vertical planes are shown in the isometric view and represent a plane directly in line and perpendicular to the borehole. The black line connected to the red dots represents the borehole and runs through the vertical plane in line with the borehole. A contour legend is presented in the isometric view.

Despite the fact that k is typically considered to be dependent on the medium alone, it has been suggested that k will vary based on whether it is determined using a liquid or gas. As discussed earlier these differences in k arise due to such effects as gas slippage, variable saturation, and gas compressibility. To avoid confusion, for the remaining sections of this work, k will be defined with a subscript indicating whether it was derived using a liquid (k_l) or gas (k_g). To account for the differences between k_g and k_l Bloomfield and Williams (1995) proposed the following relationship:

$$\log k_l = 1.17 \log k_g + 1.51 \qquad [3.4]$$

Iverson et al. (2001) also suggested the use of a logarithmic relationship to correlate for differences between the use of gas and liquid:

$$\log K_l = 1.27 \log k_g + 14.11 \qquad [3.5]$$

where K_l is the liquid conductivity in units of m day^{-1} and k is in units of m^2. The relationship of Iverson et al. (2001) does not, however, allow for consideration of varying liquid and gas properties and was only used as a comparison to the relationship of Bloomfield and Williams (1995).

Because k_g and k_l may not be equivalent, two assumptions/methods were considered in the conversion from K_g to K_l:

1) the k was equivalent using either gas or water; or

2) the k determined using either gas or liquid varied by a relationship similar to that proposed by Bloomfield and Williams (1995).

Using assumption 1 ($k_g = k_l = k$) K_l was determined from Equation 3.3 by incorporating the properties of the liquid:

$$K_l = k\left(\frac{\rho_l g}{\mu_l}\right) \qquad [3.6]$$

By evaluation of Equations 3.3 and 3.6 it can be seen that for the assumption of equivalent k, Equations 3.3 and 3.6 could be combined such that only a relationship of the fluid properties was required to calculate K_l from the field measured K_g values:

$$K_l = \left(\frac{\mu_g}{\rho_g}\right)\left(\frac{\rho_l}{\mu_l}\right)K_g \qquad [3.7]$$

For assumption 2 the relationship of Bloomfield and Williams (1995) was combined with Equations 3.3 and 3.6 and rearranged to yield:

$$K_l = \left[10^{\left(1.17\log\left(\frac{K_g\mu_g}{\rho_g g}\right)+1.51\right)}\right] * \left[\frac{\rho_l g}{\mu_l}\right] \qquad [3.8]$$

In this study no tests were conducted using water and therefore, a specific relationship between k_g and k_l, similar to that of Bloomfield and Williams (1995), could not be developed. Therefore, for completeness both Equations 3.7 and 3.8 were used to determine K_l from the field measured K_g values.

3.6.5 Verification of Flow Regime

Differences between the resulting cross-hole horizontal gas conductivity (K_{gx}) and the single-hole gas conductivity (K_{gs}) and increases in the ratio of the simulated to measured drawdown in the test interval were observed upon a review of the test data. It was hypothesized that this may have been caused by the onset of turbulent flow in the vicinity of the test interval. Assessment of the flow regime is typically conducted using the Reynolds number (Re) and is a measure of the ratio of inertial to viscous forces. At low values of Re viscous forces dominate and the flow is laminar, however, once the critical Reynolds number (Re_c) has been exceeded the dominant form of energy loss is associated with inertial forces. Once the flow has begun to transition from laminar to turbulent, the pressure drop will increase non-linearly with respect to the flow rate. In an attempt to maintain laminar conditions in the field, the applied flow rates were maintained at the minimum possible values. However, due to the apparent high K_g of the S^o block, high flow rates were required in order to produce a measureable pressure response in many of the test intervals.

To evaluate the flow conditions within the S^o block during gas testing Re numbers were calculated assuming that the primary conduit for fluid flow was through the fractures. Re values were calculated for the fractures using the following equation (Iwai, 1942; Lee and Farmer, 1993, Louis, 1969):

$$\mathrm{Re} = \frac{\rho v D_h}{\mu} \qquad [3.8]$$

where, ρ is the gas density (kg m^{-3}), v is the fracture velocity (m s^{-1}), D_h is the hydraulic diameter (m) equal to twice the fracture aperture (b) and μ is the dynamic viscosity (Pa s).

The most critical velocity will be that within a fracture in the immediate vicinity of the borehole. As the distance from the borehole increases the velocity will become smaller as the flow disperses across a greater number of fractures. To determine the velocity corresponding to the measured flow rates an estimate of fracture aperture, b, was required. Estimates of b for the horizontal fractures were computed using the cubic equation for a single set of parallel, uniform and smooth walled fractures (Snow, 1968):

$$K = \frac{b^3 \rho g}{S 12 \mu} \qquad [3.9]$$

where b was assumed to be the effective fracture aperture (m) and S was the mean fracture spacing (m). For simplicity Equation 3.9 was modified such that the aperture was represented by b rather than 2b as initially proposed by Snow (1969). The fracture spacing was taken from the fracture mapping data from previous studies of the block (Bonstrom, 2007; McKenna, 2004a) and borehole video analysis in this study. This fracture study data combined with data obtained from the gas cross-hole tests was used to determine an effective aperture.

The effective aperture of the vertical fractures was computed using the cubic law for a network of orthogonal fractures (Bear et al., 1993):

$$K = \frac{\rho g}{12L\,\mu}\left(\sum_{i=1}^{m_1} b_i^3 + \sum_{j=1}^{m_2} b_j^3\right) \qquad [3.10]$$

with the fracture porosity, φ_f, defined as:

$$\phi_f = \left(\frac{\sum_{i=1}^{m_1} b_i + \sum_{j=1}^{m_2} b_j}{L}\right) \qquad [3.11]$$

where L is the characteristic length (m) or the distance perpendicular to the direction of flow, b_i and b_j are the aperture of the fractures in the i^{th} and j^{th} directions respectively (m), and m_1 and m_2 represent the number of fractures for the i^{th} and j^{th} sets. Equation 3.10 is an extension of the cubic law for a series of parallel fractures (Bear et al., 1993):

$$K = \phi_f \frac{b^2 \rho g}{12\mu} \qquad [3.12]$$

It was assumed that the spacing and aperture of each set of fractures and between the sets was equal. Therefore, Equation 3.10 was reduced to:

$$K = \left(\frac{2mb}{L}\right)\frac{b^2 \rho g}{12\mu} \qquad [3.13]$$

Typically it is assumed that the fractures are the same length as the characteristic length, L (Figure 3.20). However, for the case of the S° block the vertical fractures were typically shorter in length than the test interval (Figure 3.20). Therefore, it was deemed more applicable to represent the fractures in terms of the porosity and thus Equation 3.10 was rearranged to account for porosity as shown in Equation 3.12.

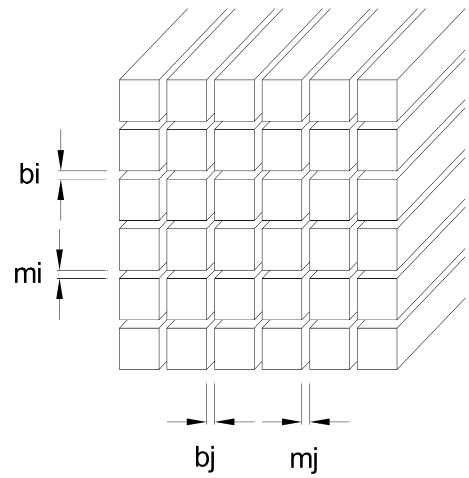

Figure 3.20 Schematic illustrating two sets of orthogonal fractures for a cube of dimension L (adapted from Bear et al., 1993). b and m represent the fracture aperture and the number of fractures in the i^{th} and j^{th} directions, respectively.

Equations 3.9 and 3.12 are similar and differ only in that Snow (1969) accounts for the fractures by means of a mean spacing, whereas, Bear et al. (1993) takes into the fractures by incorporating the porosity. To ensure that the cubic law was equivalent when the fractures were represented by either the fracture spacing or porosity, a comparison of the equations of Snow (1969) [Equation 3.9] and Bear et al. (1993) [Equation 3.12] was conducted and is presented in Appendix B.

In a similar manner the porosity for the case of two sets of orthogonal fractures was derived based on the volume of the fractures to the total volume such that Equation 3.11 was rewritten and further simplified to:

$$\phi_f = \frac{\left(\sum_{i=1}^{m_1} b_i + \sum_{j=1}^{m_2} b_j \right) L^2}{L^3} = \frac{2mb}{L} \qquad [3.14]$$

The term $\frac{2mb}{L}$ in Equation 3.13 was replaced by ϕ_f as illustrated in Equation 3.14. For the case of the vertical boreholes (Figure 3.21), the vertical fracture porosity was calculated based on the number of fractures per test interval and the mean length of these vertical fractures.

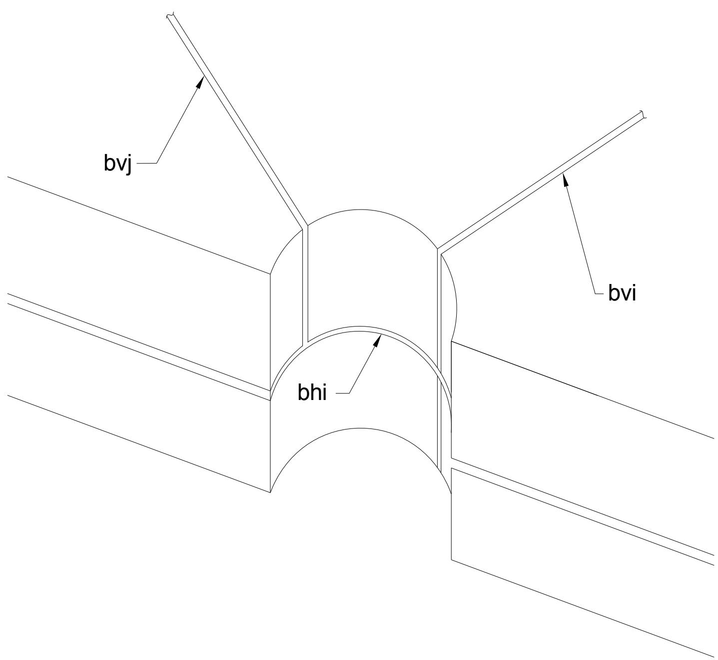

Figure 3.21 Schematic illustrating conceptualized fracture intersection of a typical vertical test interval based on visual observation from borehole video logging. b_v and b_h represent the fracture aperture of the vertical and horizontal fractures, respectively. The subscripts i and j are used to characterize the direction of the vertical fractures.

A similar procedure was followed to determine the effective aperture of the vertical fractures (b_v) for the angled boreholes (Figure 3.22). For the angled boreholes it was assumed that one set of the vertical fractures would be intersected in a direction parallel to the borehole (b_{vj} in Figure 3.22) with the other running perpendicular (b_{vi} in Figure 3.22). Therefore, the fracture porosity was calculated differently for each set. To determine the porosity of the fractures perpendicular to the direction of the borehole, the circumferential area of each fracture was determined as a function of the aperture and multiplied by the number of fractures per test interval. The porosity of the vertical fractures running the length of the borehole was determined by multiplying the mean length of these fractures by the aperture and the number of fractures per test interval. Although, a third dimension is required to determine the fracture volume it was disregarded as the calculation of both the fracture and total volume contain this common dimension and upon computing the porosity would cancel out.

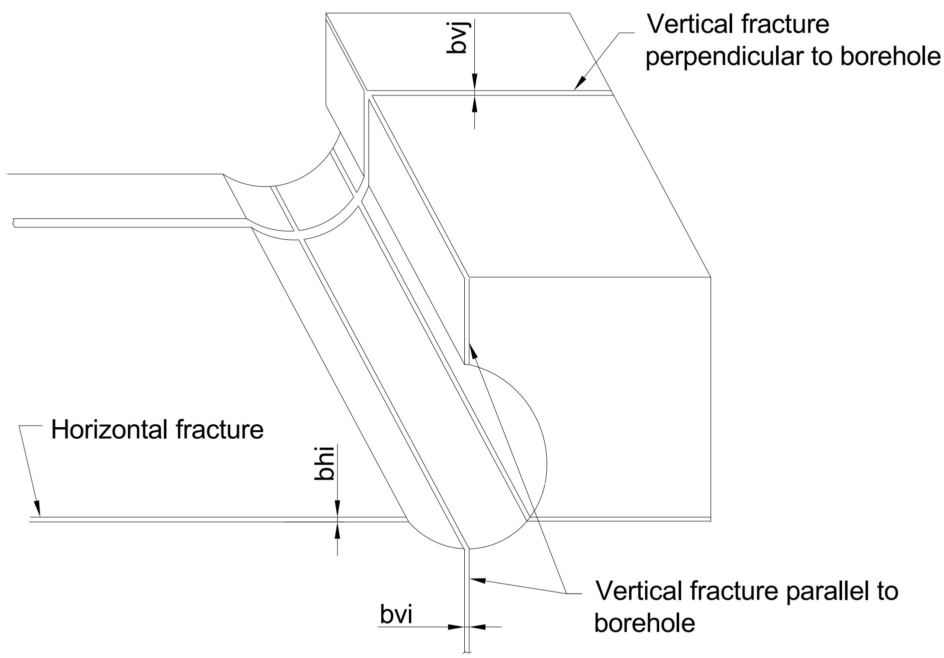

Figure 3.22 Schematic of conceptualized fracture intersection of a typical angled test interval based on visual observation from borehole video logging.

3.6.6 Estimation of Fluid Properties

To determine both K_g and K_l an assumption of the fluid properties within the block was required. Because a pumping test was used in this study, control of the gas properties (density and viscosity) was not possible and an approximation of the ambient gas characteristics of the block had to be made. In addition, since the block is likely to store solutions of high strength acids, the physical properties of various concentrations of aqueous H_2SO_4 needed to be considered. Therefore, several potential combinations of varying gas and liquid compositions were used and are discussed in the following section.

To limit the number of potential combinations it was decided that only select gas and liquid compositions would be considered. These combinations were considered for one test series only (A vertical series) to illustrate how the selection/estimation of the fluid properties may alter K_l. For the remainder of the tests only one gas and liquid composition were considered. The choice of fluids was made based on the assumed range of gases and liquids that may be present in the block. In addition the effect of temperature on the fluid properties was also considered for a range of temperatures from 0 to 25 ^oC.

The types of gases considered are summarized as follows:

- average of the measured gas concentrations in the vicinity of the gas tests (AGC);
- dry atmospheric air (DA); and
- humid atmospheric air (HA)

For each test conducted in this study an estimation of the AGC was made based on the gas concentration measurements of Birkham et al. (2010b) for a similar depth and nearest to the test location. The major constituents of the AGC consisted of N_2, O_2, CO_2, and Ar. The range of each fraction of gas used were as follows:

- N_2 – 85.0 to 95.0 %;
- O_2 – 0.4 to 15.0 %;
- CO_2 – 0.5 to 3.8 %; and

- Ar – assumed constant at 0.9 %.

Properties of standard air were used for DA. Although, the probability of the in situ gas being dry was highly unlikely, a paper by Tsilingiris (2008) illustrated that below temperatures of 40 ^{o}C the effects of humidity on both the density and viscosity are negligible. Therefore, HA was considered only for completeness and to illustrate that at the respective block temperatures, high levels of humidity have a negligible effect on the calculation of K_l.

The dynamic viscosities of various pure gases and of standard air were obtained from tabulated values (CRC, 2009). Sutherland's formula, (Crane, 1988), was used to extend the dynamic viscosity of these pure gases and standard air for various temperatures. The dynamic viscosity for the field measured AGC were determined using a semi empirical relationship proposed by Wilke (1950), capable of defining the dynamic viscosity of pure and binary gas mixtures. Corresponding gas densities were calculated using the ideal gas law relationships of mass and volume based on the various concentrations of each constituent. The dynamic viscosity and density of saturated air were estimated using an empirical relationship by Tsilingiris (2008).

Four different liquid compositions were considered in the conversion from k_l to K_l:

- Water (H_2O);
- H_2SO_4 – pH = 1 (pH 1);
- H_2SO_4 – pH = 0 (pH 0); and
- H_2SO_4 – pH = -2 (pH -2).

The density of the aqueous H_2SO_4 solutions was interpolated from the tabulated data of Myhre et al. (1998). The dynamic viscosity of each H_2SO_4 solution was interpreted from the graphs of Bump and Sibbitt (1955) and tables of Rhodes and Barbour (1923). The combinations of gas and liquids used in the calculation of K_l are summarized in Table 3.1.

3.7 Internal Acid Strength of the S^o Block

To determine the internal acid strength of the above ground S^o blocks, measurements of the in situ RH and the relationship between RH and various concentrations of aqueous H_2SO_4 (Wilson 1921) were used. The in situ relative humidity of the block was measured using three methods: borehole packer string, syringe extraction, and continuous pumping.

Table 3.1 Summary of the combinations of gas and liquids used in the calculation of the conductivity.

Combination ID	Gas	Liquid	Liquid Concentration
1	AGC	H_2SO_4	pH 0
2	HA	H_2O	---
3	DA	H_2O	---
4	DA	H_2SO_4	pH 1
5	DA	H_2SO_4	pH -2
6	AGC	H_2O	---
7	AGC	H_2SO_4	pH 1
8	AGC	H_2SO_4	pH -2

3.7.1 Borehole Packer String

The first method attempted to measure the in situ RH was a packer string installed in the three vertical boreholes (A, B, and C). The intent and advantage of the use of packers, was to isolate numerous intervals within the block and record continuous in situ measurements of the block RH through natural air exchange and diffusion processes. Another advantage of the packer string method was that the RH was measured from within the block and would not require a correction for temperature such as if it were measured at the block surface.

The packer string consisted of six open intervals separated by seven packers, constructed in 7 modules for ease of transport. Each section consisted of a 2 m long piece of schedule 40 PVC pipe (i.d. 50.8 mm), with the addition of 2 modified 101.6 by 50.8 mm PVC reducers spaced at 1 m intervals over which a 101.6 mm diameter tubular gum rubber sleeve was adhered. Four small holes were drilled in the PVC pipe beneath the gum rubber to inflate the rubber and create a seal against the borehole wall. A schematic of the packer string is illustrated in Figure 3.23. Each modular packer section was leak tested by placing it in a 152.4 mm PVC pipe, pressurizing it, and leaving it for 24 hours after which the initial and final pressures were compared. If after 24 hours the pressure had dropped by more than 7 kPa it was assumed there was leak in the system. The location of the leak was identified (cover an area in soap and watch for bubbles), it was sealed, and the system retested.

The complete packer string was assembled in the field by connecting the modular sections using threaded joints and a solvent-based PVC glue. Each section was suspended in the borehole while additional sections were connected. Within each open interval an ibutton was installed to measure the temperature and RH. The ibuttons were initialized prior to being attached to the packer system and were set to record the temperature and RH every fifteen minutes. A PVC cap was glued to the bottom of the pipe to seal air within the packer system. The top section of pipe (0.5 m above ground) was fitted with a reducer to which a series of valves and a pressure gauge could be attached.

Upon completion of the packer string installation a dry nitrogen gas was used to pressurize the packers. Once inflated to approximately 70 kPa the valve was closed, sealing the packer system. The pressure was measured approximately every 12 hours for 3 days to ensure that the system did not contain a leak. If the pressure dropped by any noticeable amount it was assumed that there was a leak and the system would have to be repaired. After the initial three days, weekly to bimonthly monitoring of the pressure was done by Syncrude personnel. After approximately one and a half months the packers were removed from the boreholes to download the data, after which they were then reinstalled. Because the packers were glued together, a mast (Figure 3.24) was constructed to lift the packer string out of the boreholes as one unit. This allowed for minimal stress on the pipe joints and packer sections. In the second installation temperature and RH measurement intervals, depths, and inflation pressures were identical to those as used in the first test.

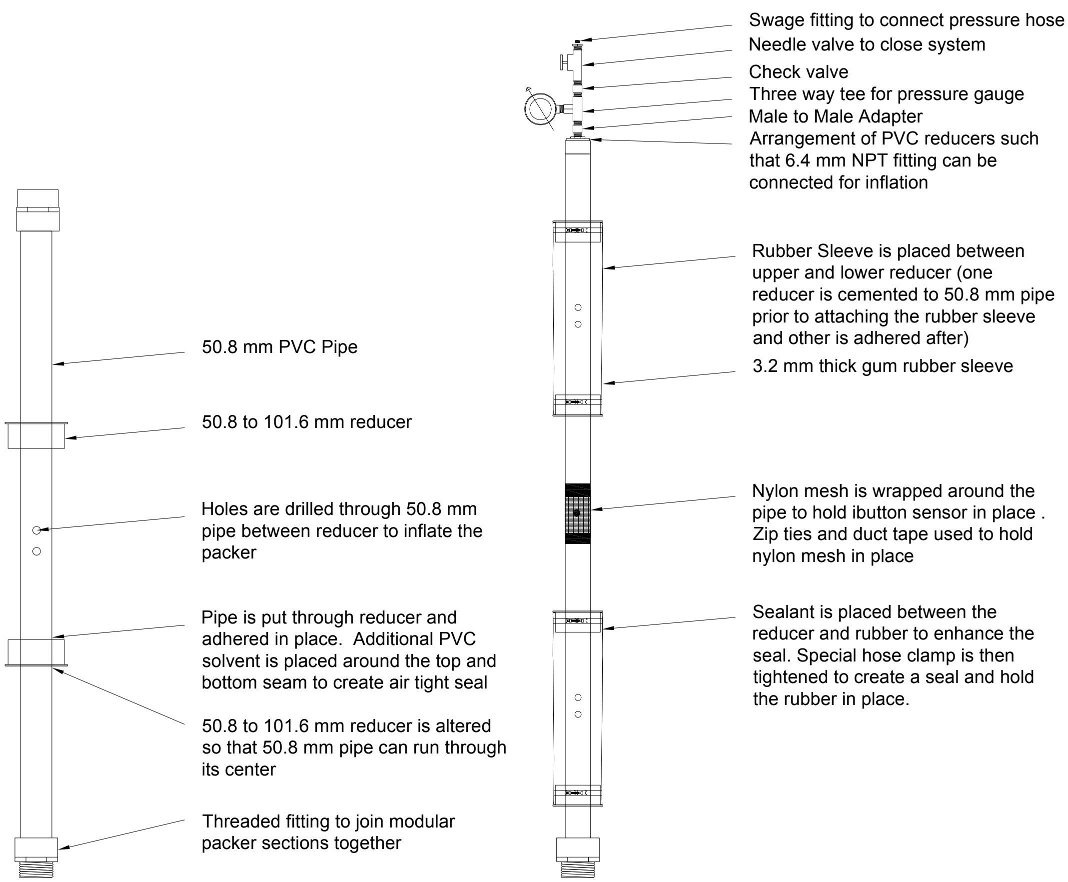

Figure 3.23 Schematic of RH packer string. On the left hand side of the image a schematic of a modular packer section without rubber sleeve is shown. On the right is a schematic of two modular sections adhered together and indicates the fittings used at the upper end of the packer string for pressurizing and sealing the packer system and indicates the location of the ibuttons on the packer string.

3.7.2 Syringe Extraction

The second method to measure RH relied on sampling air pumped from the CMTs via a 60 ml plastic syringe (Figure 3.25). The syringe was connected via a three-way luer lock to the CMT so that purged air could be either released to the atmosphere or sealed in the syringe for measurement. Prior to purging the CMT an ibutton was initialized and placed in the syringe and programmed to measure every 5 s. The procedure first involved purging each CMT by an amount equal to the volume of each CMT channel. Once purged, air from the CMTs was captured in the syringe and sealed for two to three minutes to allow the temperature and RH to stabilize.

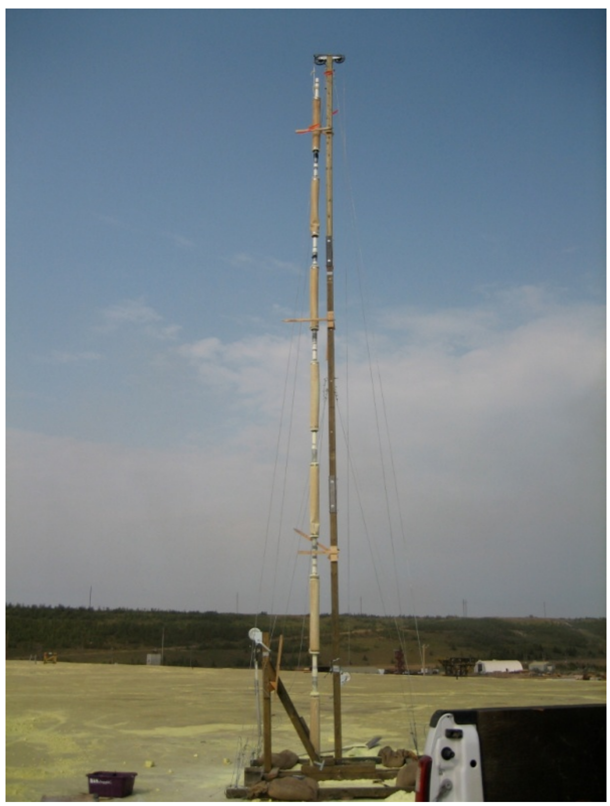

Figure 3.24 Photograph of mast used to remove packer system from vertically oriented boreholes. The photograph shows the mast in an upright position with all of the packer sections presently hoisted out of the ground.

3.7.3 Continuous Pump System

The last method used to measure in situ RH was a using a series of modified Hagan Elite aquarium pumps with flow rates ranging from 5.1 x 10^{-5} to 7.9 x 10^{-5} m^3 s^{-1}. The pumps were installed to measure temperature and RH in the fall of 2008 and 2009 with only slight differences (discussed below) in the test methodology. The small aquarium pumps were modified to suck rather than to inject air (Figure 3.26). Each pump operated using a small diaphragm that vibrated continuously, moving small amounts of air in out of the pump chamber. During normal operation of the pumps the diaphragm intakes air from the edge of the pump chamber. Therefore, to create suction the edges were sealed and a small hole was drilled in the side of the pump chamber to force air through a centralized location. Tygon tubing (6 mm diameter) was attached to this small hole and connected to the top of a 250 ml caning jar (primary suction line). A second Tygon tube of identical size was connected at the exit location of the pump. A third Tygon line of identical size was run from the top of the jar and connected to each of the CMT channels (secondary suction line) and sealed such that outside air could not be pulled into the system during pump operation. To ensure there were no leaks, the pump was run with the secondary suction line plugged. A plastic bag was sealed around the exit line. If there were a leak in the system the bag would fill up with air. In such a case sealant was placed around each joint until the leak was no longer detected.

An ibutton was inserted into each of the jars after being initialized and the jar was then sealed. During operation the pumps pulled air from the jar causing air to be pulled from the CMT. The air was directed over each of the ibuttons and measurements were recorded every 15 minutes. The pumps were sealed into two coolers with the pump discharge lines outside of the cooler.

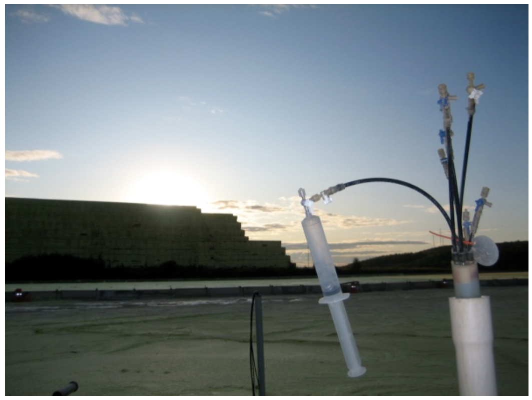

Figure 3.25 Photograph of typical setup for syringe extraction method for RH measurement. In the image a 60 ml syringe, connected to one of the CMT channels, has been filled with air and the ibutton sealed within is measuring the temperature and RH.

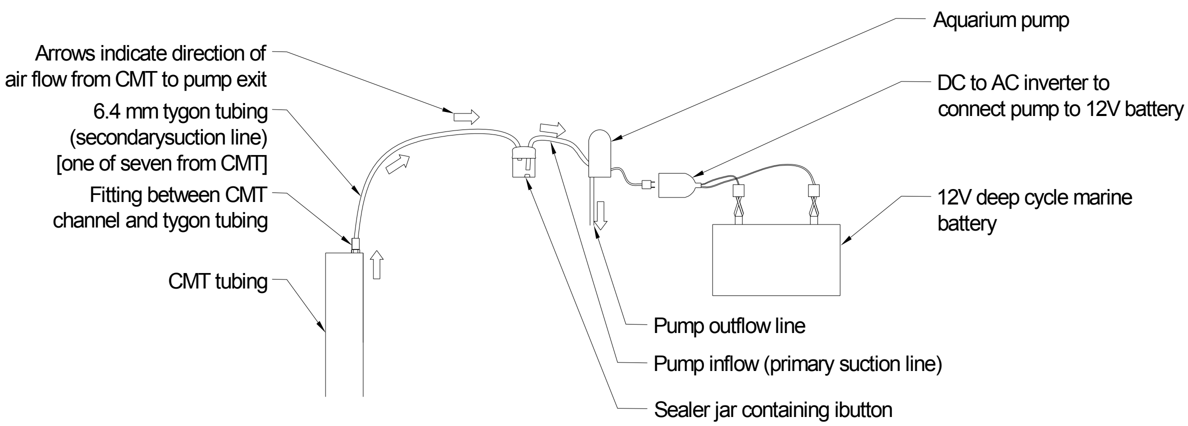

Figure 3.26 Basic schematic of RH pump setup. Schematic illustrates the connections between the pump, jar, and CMTs, location of the ibutton, battery connections to run the pumps, and the direction of airflow.

During the 2009 field season the coolers were insulated with a standard house batting type insulation, to minimize temperature fluctuations and to reduce the rate of temperature change. In 2009, the CMT and pumps were also covered with a white tarp to reduce temperature effects due to sunlight during the day and to keep the system dry. Power to the pumps was provided via two 12 V marine batteries. A small inverter was used to convert between DC and AC power. Near completion of the 2008 fieldwork it was observed that the pumps were not running 24 hours a day despite the use of solar panels. To rectify the problem a load test was conducted to determine the power requirements of the pump system. It was determined that a large number of 15 W solar panels would be required to match the pump systems power requirements at such a late stage in the year (short days). Therefore, during the 2009 field season two 15 W solar panels were installed to offset much of the power losses accrued during the day and the 12 V batteries were exchanged with a fresh pair each evening. The solar panels were strapped down to a wooden pallet to reduce movement due to high winds and were inclined to capture to the largest amount of sunlight during the day. The pump system can be seen below in Figure 3.27.

In 2008 the pumps were installed to record measurements at CMT 129 (depths 4.4 and 6.4 mbss) and CMT 131 (depths 10.4, 12.4, and 14.4 mbss). However in 2009, the pumps had to be relocated to the southern end of the Phase 1 block as an emergency pour was being conducted in the vicinity of CMTs 129 and 131. In 2009 the pumps recorded measurements from CMT 143 at seven depths: 1, 3, 5, 7, 11, 13, and 15 mbss.

Figure 3.27 Photograph of pump system used to obtain continuous in situ RH measurements. In the image the insulation and tarp have been removed and the coolers, solar panels, and CMT connections can be identified.

3.7.4 Ibutton Correction

After interpretation of the RH data collected from the syringe extraction method it was determined that there was an error in either the syringe extraction experimental methodology, interpretative technique, or the accuracy of the ibuttons. To evaluate the accuracy of the ibuttons, each ibutton was compared using an RH chamber manufactured by Thunder Scientific (model: 1200) with an operating range of 10 to 60 ^{o}C and 10 to 95 %RH. The device was used to control the RH and temperature conditions within a sealed chamber while the ibuttons recorded continuous measurements. The temperature in the chamber was adjusted from 5 to 45 ^{o}C with a range of RH conditions from 10 to 100 % at each temperature increment. Assuming the chamber was accurate, the recorded data was used to build a correction factor to adjust the ibutton measurements dependent on both the temperature and RH conditions. The correction factor was used to adjust the ibutton data for each RH field measurement technique.

CHAPTER 4.
RESULTS AND DISCUSSION

4.1 Introduction

The results of the fracture characterization study, single- and cross-hole conductivity tests, and RH measurement are discussed in this chapter. In the previous chapter, most of the experimental and analytical methodology required for data acquisition and analysis was presented. However, for some of the tests, the general methodology is expanded upon to provide additional context and clarity for the presentation of the results.

4.2 Fracture Characterization

The digital images from the borehole videos were interpreted qualitatively to evaluate:

- Fracture orientation (e.g. vertical, horizontal, or subhorizontal);
- Fracture opening (e.g. open or closed); and
- Evidence of staining, which could be indicative of the presence of bacteria or organic matter.

An ‘open’ fracture was defined as a fracture in which a visible separation could be observed with the naked eye. The only quantitative features identified from the borehole recordings were the fracture frequency and the apparent length of vertical or sub-vertical fractures that intercepted the borehole.

Bonstrom et al. (2009) suggested that the horizontal fractures coincided with lift interfaces; however, in this study it was observed that many of the fractures adjacent to lift interfaces were closed and in some instances could only be identified by a change in the crystal structure or by dark staining/indentation along the fracture face (Figure 4.1). However, open fractures coinciding with lift interfaces could be potentially open along the expanse of the lift interface and would likely be more interconnected than vertical fractures. Lift interfaces were identified by an abrupt change in color/texture of the S° and were typically continuous around the circumference of the borehole. Although, many of the fractures encountered were closed, open horizontal fractures were observed in both the vertical and angled boreholes. Open fractures varied between large voids distributed along the fracture face (Figures 4.2 and 4.3), partially open fractures (Figure 4.4), open fractures (Figure 4.5) and partially open/crystal-infilled fractures (Figure 4.6).

Although, it was postulated that the vertical boreholes would intercept primarily horizontal fractures, vertical fractures were observed in both the vertical and angled boreholes, indicating a dense network of vertical fractures. The density of vertical fractures and interconnectedness between horizontal and vertical fractures and of vertical fractures running in variable directions was evident in the angled boreholes. This is illustrated by a comparison of the vertical fractures in a vertical borehole (Figure 4.7) and those in an angled hole (Figures 4.8 and 4.9).

Figure 4.1 Video still image from B angular borehole (BA-15-Appendix C). Photo illustrates change in crystal structure from dark blocky crystal structure in the upper portion of the photo to duller material in the middle portion of the photo.

The fracture spacing was determined for each 1.38 m test interval and for the entire length of the borehole. The horizontal fracture spacing (calculated per test interval), including open and closed fractures, ranged from 0.03 to 0.07 m with a mean spacing of 0.05 m. The spacing of open fractures (per test interval) ranged from 0.09 to 0.33 m with a mean of 0.16 m. The mean fracture spacing over the entire length of the borehole was 0.05 m for all fractures (i.e. open and closed) and 0.15 m for open fractures. As can be seen in Table 4.1, calculation of the fracture spacing per test interval and over the entire length of the borehole produced similar results.

Figure 4.2 Video still image from C vertical borehole (CV-7-Appendix C). Looking laterally at one of several large open voids dispersed along a horizontal fracture face.

Figure 4.3 Video still image from C vertical borehole (CV-12-Appendix C). Looking laterally at numerous large open voids dispersed along a horizontal fracture face.

Figure 4.4 Video still image from B angular borehole (BA-30-Appendix C). Looking in a slightly downward direction and laterally at an open horizontal fracture.

Figure 4.5 Video still image from B angular borehole (BA-20-Appendix C). Looking directly down the angled borehole at a partially open horizontal fracture. Water droplets can be seen on the right hand side of the photo and at the top of the borehole.

Figure 4.6 Video still image from B angular borehole (BA-23-Appendix C). Looking laterally at a partially open and crystal-infilled horizontal fracture. Water droplets can be seen on and around the fracture.

Figure 4.7 Video still image from C vertical borehole (CV-14-Appendix C). Looking laterally at dark stained vertical fracture originating from horizontal fracture.

Figure 4.8 Video still image from B angular borehole (BA-6-Appendix C). Looking directly down angled borehole at various vertical fractures. Fracture on the left and right hand side of image is oriented downwards. These fractures appear to run the entire circumferential length of the borehole while several fractures in the center of the image are in the direction of the borehole. Vertical fractures appear to originate from large dark stained horizontal fracture.

The vertical fractures were categorized based on the number of fractures and the length of each fracture, rather than spacing. The number of vertical fractures per test interval (open and closed fractures) ranged from 5 to 24 with a mean of 12 and with lengths ranging from 0.07 to 0.20 m and a mean of 0.15 m. The number of open vertical fractures ranged from 1 to 9 with a mean of 5 per test interval.

The number of vertical fractures for the angled boreholes was further separated into those that ran parallel to the borehole and those that intersected the borehole perpendicular to the borehole direction. The number of open fractures parallel to the borehole ranged from 1 to 3 with a mean of 2 with lengths ranging from 0.04 to 0.25 m with a mean of 0.14 m. The number of perpendicular vertical fractures ranged from 1 to 6 with a mean of 3 and lengths ranging from 0.06 to 0.31 m with a mean of 0.19 m. Borehole video annotations and digital recordings of the borehole camera footage can be found in Appendix C. Video snapshots corresponding to the borehole notes are provided in Appendix D. A summary of the fracture characteristics, determined from the borehole video logging, is provided in Table 4.1.

Figure 4.9 Video still image from B angular borehole (BA-3-Appendix C). Looking in slightly downward direction towards the top of the borehole at vertical fractures running down the top of the borehole. Fractures appear to originate from a single vertical fracture running parallel to the borehole. The vertical fractures intersect the open portion of horizontal fracture near the bottom of the image.

The horizontal fracture spacing of the Phase 1 block observed in this study and by others (McKenna, 2004a; Bonstrom, 2007) is presented in Table 4.2. The horizontal fracture spacing determined from the borehole video logging is consistent with data from fracture mapping studies conducted on the Phase 1 block by McKenna (2004a) and Bonstrom (2007; horizontal fracture spacing was inferred from data). The pattern, number, and characteristics of the fractures of the Phase 1 block were noted by McKenna (2004b) to be similar to other S^{o} blocks across Alberta. Because the method of block construction is similar around the world, the results from study of the Phase 1 block at SCL should of value internationally.

Table 4.1 Summary of number of fractures, fracture spacing, and fracture lengths based on the borehole video logging.

	B Angular Borehole	C Vertical Borehole
Vertical borehole length (m)	10.7	11.0
Horizontal Fracture Properties		
Number of fractures	203	277
Number of open fractures	84	78
Average fracture spacing (all fractures - entire borehole)	0.05	0.04
Average fracture spacing (open fractures - entire borehole)	0.15	0.14
Average fracture spacing (all fractures - per test interval)	0.05	0.04
Average fracture spacing (open fractures - per test interval)	0.19	0.13
Vertical Fracture Properties		
Number of fractures	102	126
Number of open fractures	38	34
Minimum length of vertical fractures (parallel)	0.06	0.07 [1]
Maximum length of vertical fractures (parallel)	0.31	0.20 [1]
Average length of vertical fractures (parallel)	0.20	0.15 [1]
Maximum length of vertical fractures (perpendicular)	0.21	---
Minimum length of vertical fractures (perpendicular)	0.04	---
Average length of vertical fractures (perpendicular)	0.14	---

Notes:

- Superscript [1] indicates that the fracture length is the vertical fracture length for the case of the C vertical borehole.

Table 4.2 Summary of the mean horizontal fracture spacing from mapping studies conducted on the Phase 1 S^o block.

Fracture Spacing (m)	Reference ---
0.20	Bonstrom (2007) [1]
0.15	McKenna (2004a)
0.16	Current Study

Notes:

- Superscript [1] indicates that the mean horizontal spacing of Bonstrom (2007) was inferred from the raw data.

Both the horizontal and vertical fracture densities are plotted with depth in Figures 4.10 and 4.11. A recognizable pattern between the fracture density and depth (Figures 4.10 and 4.11) was not observed for any of the test series with the exception of the C vertical borehole. The vertical fracture density for the C vertical borehole appeared to decrease with depth. No pattern or unique characteristics were observed to explain this phenomenon.

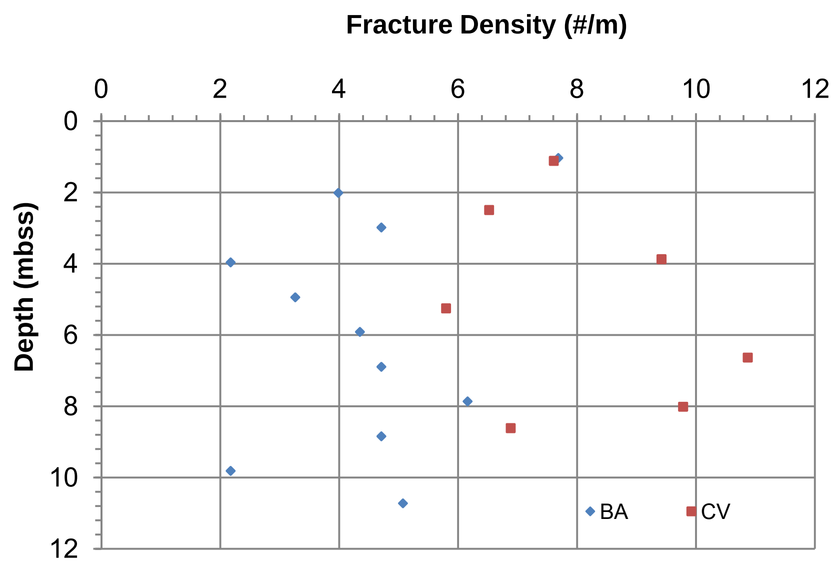

Figure 4.10 Horizontal fracture density versus depth below the surface of the S° block. The data markers represent fracture density (open fractures only) over the test intervals. The depth is to the center of the test interval. The legend items BA and CV refer to the B angular and C vertical test series, respectively.

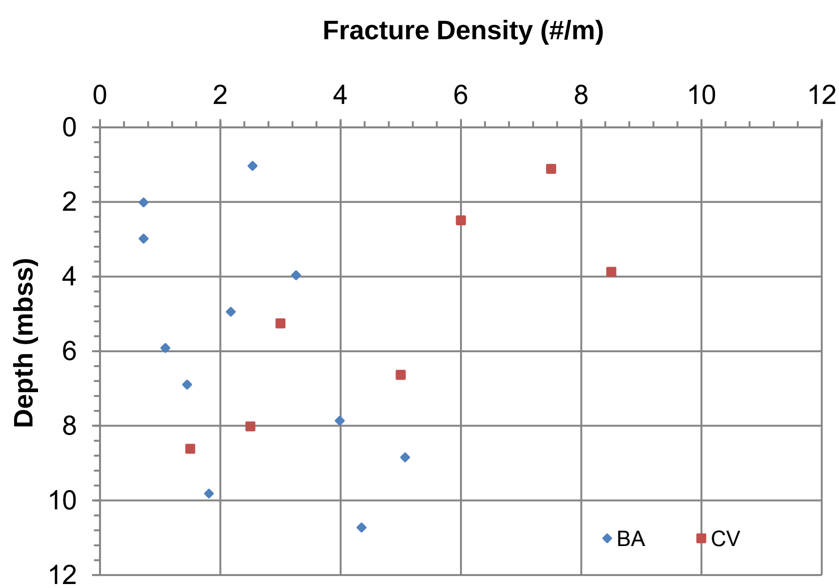

Figure 4.11 Vertical fracture density versus depth below the surface of the S° block. The data markers represent fracture density (open fractures only) over the test intervals. The data is plotted against the vertical depth to the center of the test interval. The legend items BA and CV refer to the B angular and C vertical test series, respectively.

Water droplets were observed on the top and sides of many of the angled boreholes (Figure 4.12). Although, water droplets were observed occasionally in the vertical boreholes, such observations were not as common as in the angled boreholes. No pattern or unique characteristics were observed to explain this phenomenon. In general, the water droplets were not present along the entire length of the borehole but were observed in only a few isolated locations. A pH strip was attached to a section of pipe and lowered down the B angular borehole to measure the pH of the accumulated moisture. Five measurements were conducted in this manner at various depths within the borehole. All of the measured pH values indicated that the pH of the water droplets were less than or equal to 4.5 (minimum pH of indicator strip).

Figure 4.12 Video still image from the B angular borehole (BA-29-Appendix C). Looking in slightly downward direction and toward the top of borehole. Large hole can be seen at the top of the image with a partially open horizontal fracture in the center of the image. Image illustrates the accumulation of water observed in various locations along the top of the angled boreholes.

4.3 Gas Pumping Tests and Gas Conductivity

The results of the borehole cleaning, data acquisition, and inferences of the resulting data sets is presented in this section. A discussion of the results of the pumping tests with regards to the K_g is also included.

4.3.1 Borehole Cleaning Procedure

At the completion of the drilling program, each borehole was cleaned thoroughly using the procedure outlined in Section 3.3. Figures 4.13 and 4.14 illustrate the difference in the amount of dust present in the borehole before and after cleaning. The hazy appearance of the image in Figure 4.13a was due to S^o dust located on the borehole walls that was dislodged by the borehole camera as it was lowered in the hole. The pillowy texture of the borehole walls in Figure 4.13b was attributed to residual S^o dust attached to the borehole wall. Few to no fractures were identified from this footage. Once the borehole was cleaned the fractures were easily observed in the boreholes (Figure 4.14).

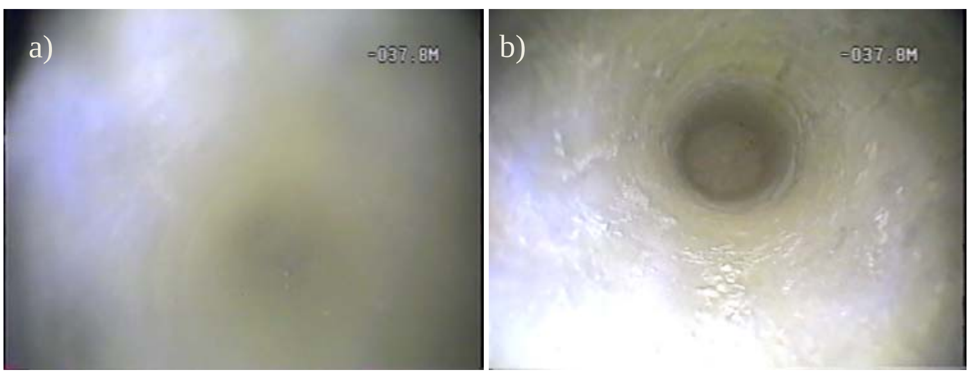

Figure 4.13 Video still image taken after drilling was temporarily stopped in a vertical borehole. Image a) illustrates falling dust dislodged by the borehole camera as it was lowered down the borehole. Image b) illustrates pillowy texture of residual S^o dust located on the borehole wall. No fractures were observed because of the accumulation of the S^o dust.

A single-hole pumping test was conducted to quantitatively assess the effectiveness of the cleaning technique to remove residual S^o dust. This was done by comparing the pressure response in the test interval before and after the secondary cleaning of the borehole. The test was conducted between the depths of 1.11 and 2.49 mbss in the C vertical borehole. A slight decrease in the test interval pressure (maximum difference 0.9 kPa) was observed for each applied flow rate (Figure 4.15) after the second cleaning. However, this decrease was considered insignificant because fluctuations in the vacuum induced small spikes in the pressure response especially at larger flow rates (discussed in section 3.5.3).

Figure 4.14 Video still image taken after cleaning an angled borehole. Image illustrates the ease of which fractures could be identified following cleaning of the borehole.

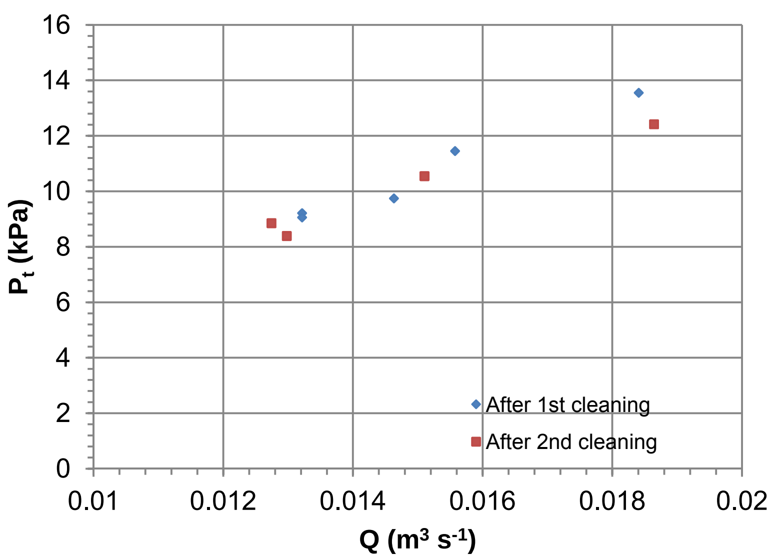

Figure 4.15 Comparison of test interval pressure and pumping rate (Q) after first and second cleaning between the depths of 1.11 and 2.49 mbss in the C vertical borehole. P_t is the test interval pressure.

Based on a comparison of the video footage before and after cleaning and only slight changes in test interval pressure response before and after a second cleaning, it was determined there would be no advantage in conducting additional cleaning. As a result, the remaining boreholes were cleaned once using the chimney sweep and industrial vacuum until the sound of material passing through the vacuum hose stopped (~approximately half an hour to an hour).

4.3.2 Test Interval Temperature and Relative Humidity

Temperature and RH within the test interval were measured during each of the pumping tests to determine the appropriate gas properties for analysis of K_g. The temperature and RH measurements for the entire B vertical series tests are shown in Figure 4.16. This pattern was typical of the response of both the temperature and RH readings during each test. Although, the temperature varied with location and depth (7.3 to 16.0 ^{o}C) of the boreholes tested, the RH in all cases approached 100 % shortly after each test began (15 to 45 minutes) with the exception of the 150909-A-Ang-1 which took nearly 90 minutes for the RH to reach 100%. The temperature remained nearly constant throughout each test typically changing between 0 to 2 ^{o}C over the duration of a test and any change typically occurred within the first few minutes of the test. The maximum change during all tests was 11.5 ^{o}C. As this test was the shallowest test in the A angled borehole, the apparatus had been sitting on the surface of the block prior to the test and therefore, took longer than was typical to equilibrate to the mean test temperature. Even in this case the temperature equilibrated to the mean test temperature within 8 minutes. As a result, the physical properties of the gas should remain constant throughout each test with respect to temperature. The irregular response of the temperature and RH in the initial portion of the graph, prior to approximately 10:00 AM (Figure 4.16), was attributed to the packer being lowered from the surface into the hole at the start of the test program. Similarly, an erratic response was observed in the data after approximately 18:30 corresponding to the removal of the packers from the borehole.

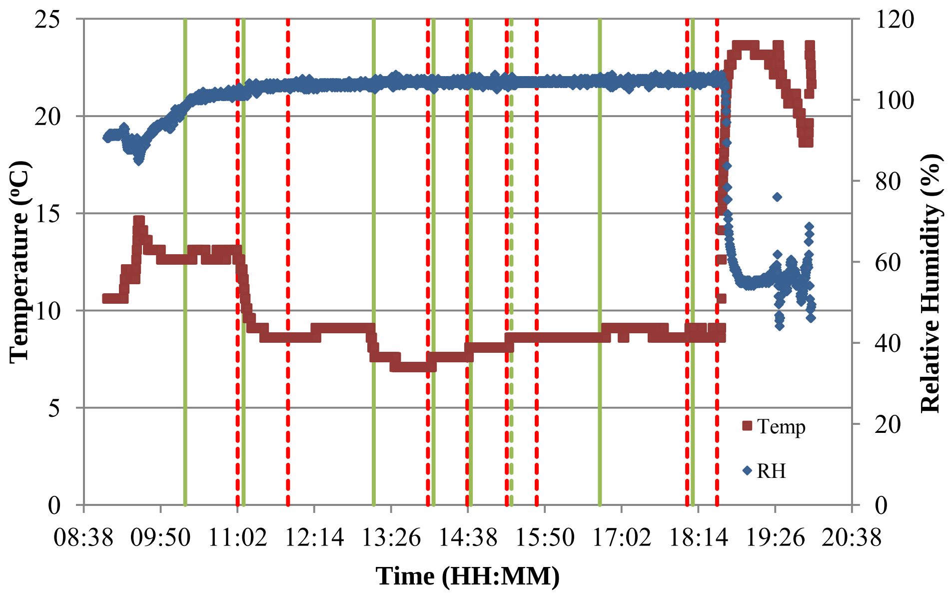

Figure 4.16 Summary of temperature and RH measured within test interval for all of the B vertical series tests. The green solid lines and red dashed lines indicate the start and end of each test, respectively. The red and blue data markers represent the RH and temperature measured in the test interval, respectively.

4.3.3 Packer Seal

The integrity of the seal between the packers and the borehole walls was evaluated using both visual inspection, where possible, and by measuring the pressure response (gauge) below the deepest packer (P_L) as outlined in Section 3.5.2. Based on visual inspection, no tests suggested a lack of seal between the borehole wall and the upper packer. The P_L measurements were compared to both the pressure response in the test interval and to the barometric pressure. It was assumed that a P_L value between the barometric and test interval pressure would indicate an acceptable seal. Figures 4.17 and 4.18 illustrate P_L below the deepest packer assembly for the C angular test series. Similar responses were recorded for all 4 of the test series where P_L was measured. P_L was not recorded for the A series tests.

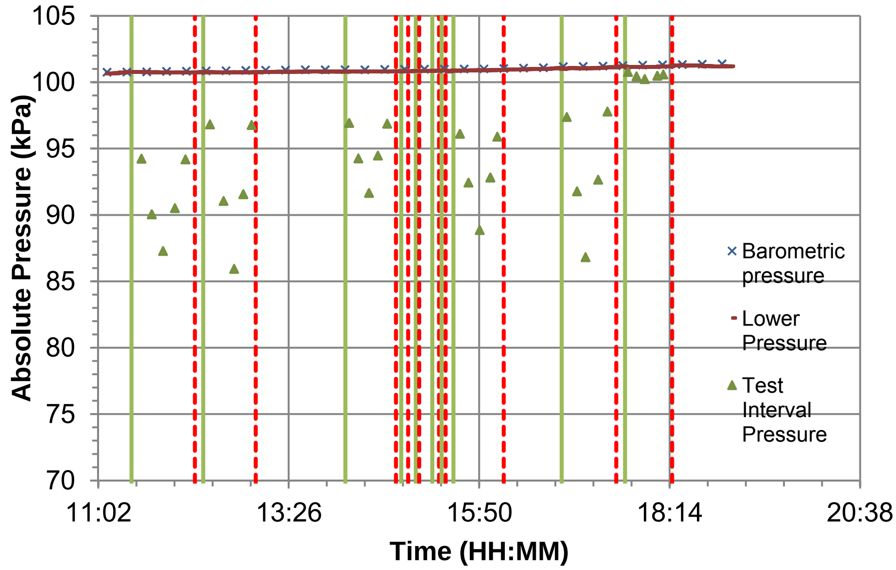

Figure 4.17 Plot of the barometric, lower (P_L), and test interval pressures for the C angular test series. Green solid lines and red dashed lines indicate the start and end of each test, respectively. The increased number of tests between approximately 14:50 and 15:30 was due to an insufficient pressure response in the test interval for these tests and as such were stopped prematurely.

In all tests in which P_L was monitored, P_L was consistently between the barometric pressure and test interval pressure (Figure 4.17) with the exceptions noted below. Although, a pressure change was not discernible by visual inspection of Figure 4.17, small perturbations in P_L (maximum change of < 1 to 8 mm H_2O) were identified for each of the C angular tests and coincided with the interval between the recorded start and stop times for each test.

For the deepest tests of the C angular test series (Figure 4.18), a decrease in P_L was easily identified during each stage of the test, which coincided with a change in the applied flow rate. The initial stage of each test was identified by a nearly vertical pressure spike that coincided with the initial application of the maximum vacuum to remove any water/dust prior to applying the normal range of flow rates. Following this pressure spike P_L typically returned to near static conditions. As the flow rate was increased P_L decreased then remained constant for the duration of each applied flow rate. At approximately 15:35 P_L exhibited a positive pressure increase exceeding the barometric pressure. As this pressure spike occurred immediately prior to the beginning of test 210909-C-Ang-4 it was most likely caused by inflation of the packers. A similar response was observed in the deepest test for the B angular borehole where the pressure increased by approximately 15 mm. Similarly this pressure increase was most likely caused by rapid inflation of the packers. A positive pressure response is typical during packer inflation (Illman, 2004).

The change in P_L was small in all tests, ranging between < 1 to 40 mm of H_2O head and in most cases was less than 1 to 2 mm. For all of the test holes where P_L was measured, changes in P_L for the shallow test locations (typical maximum pressure change: < 2 mm H_2O) were less evident in comparison to the deeper tests ranging from 14 to 40 mm H_2O. It was reasonable that the maximum P_L occurred during the deepest tests because the volume of open borehole below the packers in these tests was smaller and any pressure build up would be distributed over a smaller open volume.

Based on the data obtained in this study it cannot be determined whether the observed pressure drop was due to an insufficient seal or due to drawdown based on movement of air within the block during the test. A more rigorous method of pressure measurement and analysis criterion would be required to determine the cause of the observed drawdown below the deepest packer. However, the data indicated that the packer seal was adequate for the purposes of this study.

4.3.4 Single- and Cross-Hole Gas Conductivity

Of the 59 straddle-packer tests conducted, 53 were deemed successful in that the complete testing cycle of 5 flow rates was applied. In four tests, only one flow rate could be applied. This was sufficient to create a measureable pressure response before exceeding the maximum capacity of the flow measurement system. No measureable pressure response were achieved in two of the tests. Measurement of the pressure response at the cross-hole monitoring locations was collected when possible and is summarized in Appendix E. Cross-hole data was collected for 40 of these tests.

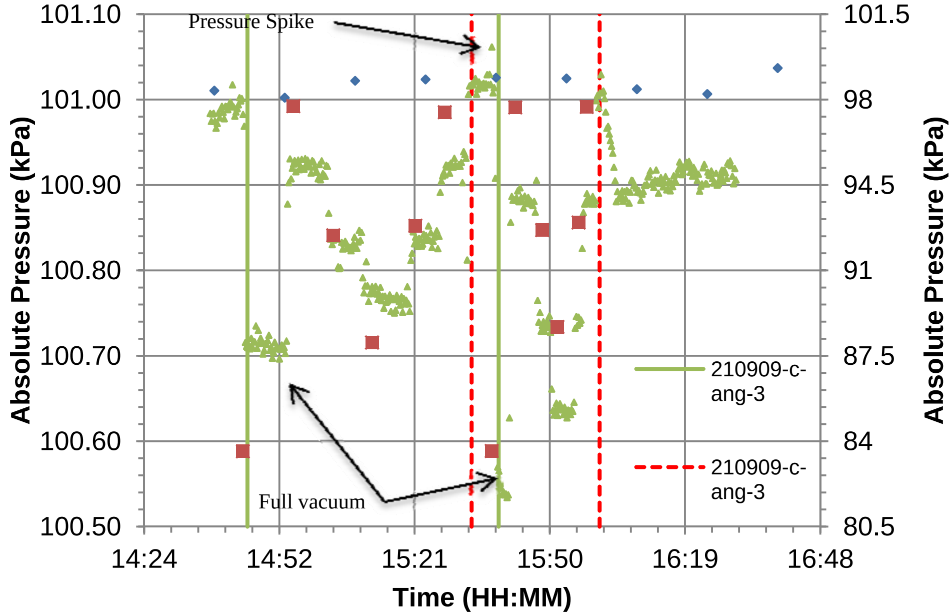

Figure 4.18 Plot of the barometric, lower (P_L), and test interval pressures for the two deepest tests of the C angular test series. For clarity, the barometric, lower, and test interval pressures for the C angular test series are plotted with two different vertical scales. The barometric pressure (blue markers) and P_L response (green markers) are plotted as absolute pressure on the primary vertical axis. The secondary axis is also in terms of the absolute pressure but the axes scale has been decreased to magnify the response of the test interval pressure (red markers).

4.3.4.1 Summary of the Gas Conductivity Values and Anisotropy Ratios

It has been illustrated by numerous researchers that the logarithmic values of hydraulic conductivity data is normally distributed (Freeze, 1975; Sudicky 1986; Woodbury and Sudicky 1991). Similarly, the gas conductivity values determined in this study were shown to be log normally distributed (discussed in Section 4.3.5). Therefore, the geometric mean was used to represent the mean values of the gas conductivity data. When included, the standard deviation (σ) of the geometric mean is reported following the geometric mean value in logarithmic scale, unless indicated otherwise. The K_{gs} values, as determined using Equation 3.1, ranged from

2.4×10^{-4} to 3.4×10^{-6} m s^{-1} with a geometric mean of 2.0×10^{-5} m s^{-1} (n = 261; σ = 0.44). The K_{gx} values determined from the numerical modeling ranged from 5.5×10^{-5} to 9.0×10^{-4} m s^{-1} with a geometric mean of 2.3×10^{-4} m s^{-1} (n = 197; σ = 0.26). A_{gr} (K_{gy} [vertical gas conductivity] : K_{gx}) values ranged from 1:100 to 1:2 with a geometric mean of approximately 7:100 (n = 197; σ = 0.49). The corresponding K_{gy} values ranged from 1.0×10^{-4} to 9.0×10^{-7} m s-[1] with a geometric mean of 1.7×10^{-5} m s^{-1} (n = 197; σ = 0.41). The single- and cross-hole K_g values and anisotropy ratios are summarized in Table 4.3.

Table 4.3 Summary of the K_g and A_{gr} values for the single- and cross-hole test data. Data is presented in terms of the geometric mean of each test series. n is the total number of results for each series for each the type of test completed. The first letter of the test series (A, B, and C) indicates the test borehole and the second letter of each test series indicates the borehole orientation (V = vertical; A = angled).

Test Series	K_{gx}	n	K_{gy}	n	K_{gs}	n	A_{gr}	n
	(m s^{-1})	(---)	(m s^{-1})	(---)	(m s^{-1})	(---)	(---)	(---)
AV	2.8×10^{-4}	35	1.7×10^{-5}	35	2.4×10^{-5}	35	0.06	35
AA	-	-	-	-	2.4×10^{-5}	46	-	-
BV	2.4×10^{-4}	40	4.2×10^{-5}	40	2.4×10^{-5}	40	0.18	40
BA	2.3×10^{-4}	40	2.0×10^{-5}	40	2.9×10^{-5}	55	0.09	40
CV	1.9×10^{-4}	35	1.3×10^{-5}	35	1.4×10^{-5}	35	0.07	35
CA	2.3×10^{-4}	47	7.7×10^{-5}	47	9.9×10^{-5}	50	0.03	47
All Data	2.3×10^{-4}	197	1.7×10^{-5}	197	2.0×10^{-5}	261	0.07	197

4.3.4.2 Numerical Modeling Results

Numerical modeling was used to estimate the K_g values from the pressure response of the cross-hole conductivity tests. These results are summarized in Appendix E. The K_{gx} and A_{gr} values were determined based on the best-fit of the simulated and measured pressure response at the monitoring locations. Neglecting the pressure at the test interval reduced error in the estimation of K_g due to skin effects and alleviated the need to account for such effects as density dependent and turbulent flow (discussed in detail in Section 4.2.6).

Comparison of the simulated and measured drawdown at the monitoring intervals, was done using both visual observations and a sum of least squares. Both methods were used because of the anomalous nature of some of the measured data sets. Figure 4.19 shows the simulated and measured drawdown for the greatest applied flow rate for the 140909-A-Vert-4 test series. Although the simulated drawdown is in good agreement with the measured drawdown at radial distances of 3.70, 4.20 and 4.73 m, the measured drawdown at r = 4.02 m appeared to be erratic, or did not fit a pattern consistent to the measured pressure response at the other monitoring locations. In most cases, when such a response was observed, it was consistent at all five flow rates and was amplified at the greatest applied flow rate. In such a case, the sum of least squares method underestimated the fit between the measured and simulated drawdown, as this one set of apparently anomalous measurements skewed the sum of least squares value. Figure 4.20, also taken from the A vertical test series, shows a much more consistent response at the r = 4.02 m monitoring location, with an exception at the depth of 10.5 mbss, where the measured pressure response was positive.

Similar inconsistent or unrecognizable responses were noted in other test locations and were usually associated with greater distances between the test and monitoring intervals. This type of phenomenon occurred for the B and C series tests where a recognizable trend was identified in only the single closest monitoring location (B vertical: 6.2 m; B angular: 7.2 m; C vertical: 6.5 m; C angular: 7.1 m) for each of these tests. The second closest monitoring location for each of the B and C series tests was a minimum of 2.5 times the distance of the closest monitoring location (B vertical: 29.0 m; B angular: 31.0 m; C vertical: 17.3 m; C angular: 21.9 m) and no recognizable pattern was observed at these monitoring locations. This trend was reproducible in the numerical simulations with the exception of those situations where A_{gr} was small and the K_{gx}

value was large. In these cases, the numerical model tended to overestimate the drawdown although the magnitude of this drawdown was typically very small. For example, during test 220909-B-Ang-4 for nearly all of the applied flow rates no measured pressure response was observed at the two furthest monitoring locations; however, as K_{gx} approached 1 x 10^{-3} m s^{-1} with an A_{gr} of 0.01, the numerical model simulated a drawdown of 0.05 and 0.02 mm H_20 at distances of 31.0 and 46.0 m from the test of location, respectively. Under these circumstances such observations were omitted from the sum of least squares calculations.

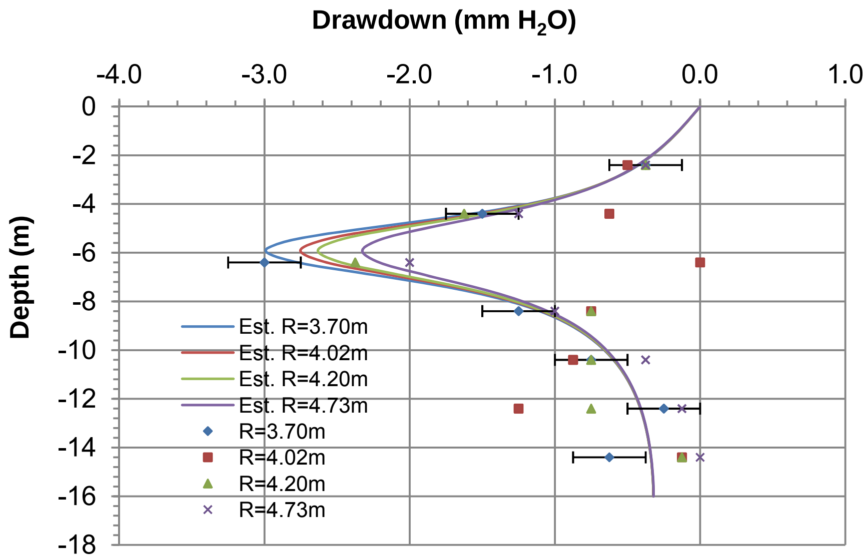

Figure 4.19 Measured and simulated drawdown versus depth for the A series test 140909-A-Vert-4 (center of test interval = 5.97 mbss, K_{gx} = 3.0 x 0^{-4} m s^{-1}, A_{gr} = 0.06). Data markers represent the field measured pressure response in mm H_2O at the monitoring locations. Solid lines represent the best-fit between the simulated and measured data. Error bars represent the resolution (± 0.25 mm) of the U-tube measurements at the CMT monitoring locations. For clarity, the error bars are shown for the nearest CMT monitoring location only.

Another factor that caused inconsistent responses at the monitoring locations was meteorological conditions. The U-tube manometer used to measure the pressure response at the monitoring locations was open to the atmosphere. Therefore, during periods of moderate gusting winds only those depths that showed a distinct and steady drawdown were unaffected by wind fluctuations. During periods of powerful gusting winds over the exposed blocks virtually no measurements could be obtained due to fluctuations in the manometer readings. As such, the pressure response at the monitoring locations for the A angular series tests were not measured due to fluctuations caused by powerful gusting winds (wind speeds unknown).

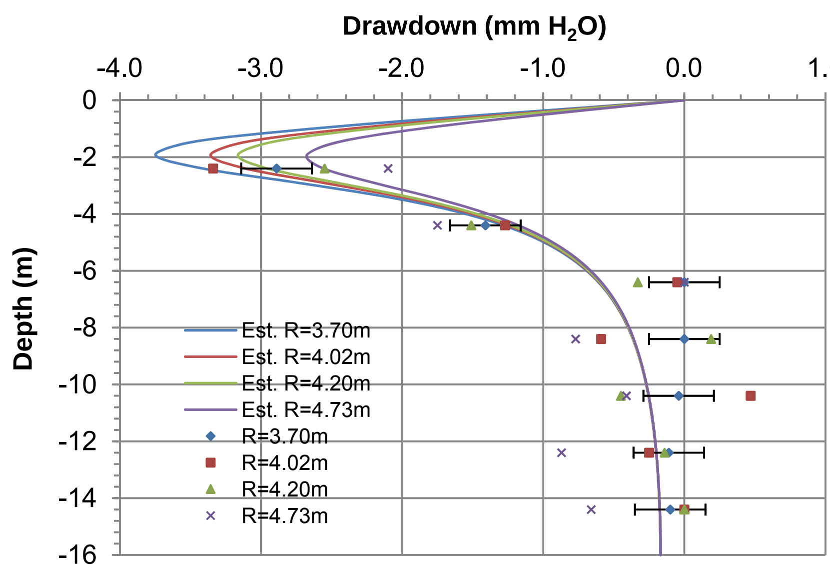

Figure 4.20 Measured and simulated drawdown versus depth for the A series test 140909-A-Vert-1 (center of test interval = 1.73 mbss, K_{gx} = 2.5 x 10^{-4} m s^{-1}, A_{gr} = 0.1). Data markers represent the field measured pressure response in mm H_2O at the monitoring locations. Solid lines represent the best-fit between the simulated and measured data. Error bars represent the resolution (± 0.25 mm) of the U-tube measurements at the CMT monitoring locations. For clarity, the error bars are shown for the nearest CMT monitoring location only.

It is important to note that the best-fit simulated and measured maximum drawdowns did not always occur at the same elevation, as shown in Figures 4.19 and 4.20. The cause for this discrepancy was attributed to the fact that the CMT gas ports used as ‘monitoring intervals’ were constructed prior to testing and, as such, the test intervals could not be altered to align with the pumping depths. In addition, an irregular pattern (Figure 3.17) was noted in the simulated pressure response at the monitoring locations for all of the tests simulated using SEEP3D for depths ranging approximately 5 to 6 mbss. This discrepancy was attributed to a lack of refinement of the mesh in the vicinity of the test interval. With a reduction of the element size in the vicinity of the test interval this irregular pattern was reduced (10 %), as seen in Figure 3.17. However, even with the greatest mesh refinement possible (~2.5 times the number of nodes; 188,764 to 467,262 nodes), this irregular pattern was not completely removed. No further refinement could be made without increasing the simulation time substantially and consequently the mesh was not refined further.

In general the vertical K_g of the S^o block was estimated to be much smaller than the horizontal (i.e. small values of A_{gr}). The reason for small A_{gr} values may be due to the genesis of the block fractures. As some of the horizontal fractures appear to be associated with lift interfaces, also indicated by others (Bonstrom, 2007; McKenna, 2004a), it is more likely that they are interconnected. This would result in greater conductivity, connectivity, and reduced tortuosity of the horizontal flow paths as compared to the vertical flow paths.

There were several cross-hole tests (230909-B-Vert-4, 230909-B-Vert-5, 230909-B-Vert-6, 230909-B-Vert-7, 220909-B-Ang-6, 220909-B-Ang-7, 220909-B-Ang-8, and 090909-C-Vert-3) in which greater A_{gr} values (0.25 to 0.5) were required to match the measured pressure responses. As an example, Figure 4.21 is a plot of the pressure response for test 230909-B-Vert-5 where a best-fit to the measured data was achieved with an A_{gr} value of 0.5. These A_{gr} values could be the result of greater interconnectedness of the vertical fractures in these areas or possibly a reduction in the aperture size or interconnectedness of the horizontal fractures.

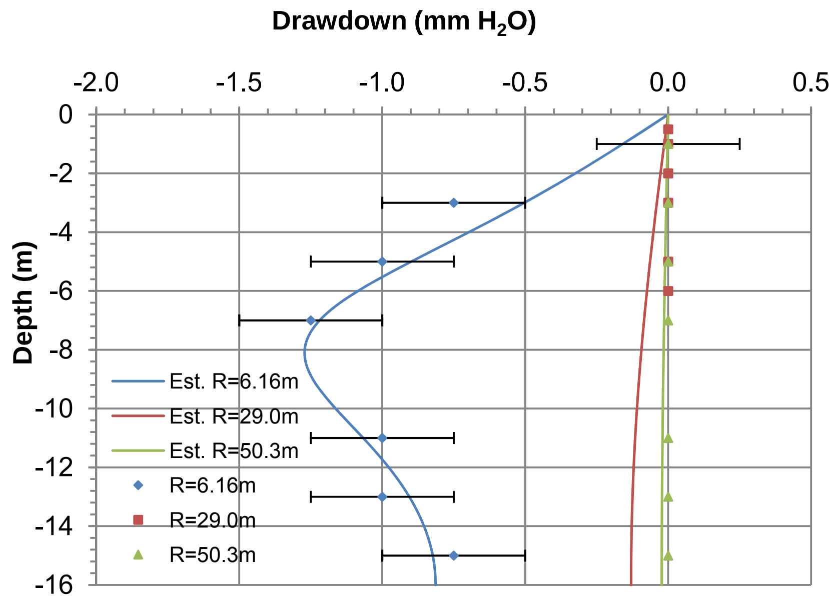

Figure 4.21 Measured and simulated drawdown versus depth for the B series test 230909-B-Vert-5 test series (center of test interval = 7.39 mbss, K_{gx} = 1.5 x 10^{-4} m s^{-1}, A_{gr} = 0.5). Data markers represent the field measured pressure response in mm H_2O at the monitoring locations. Solid lines represent the best-fit between the simulated and measured data. Error bars represent the resolution (± 0.25 mm) of the U-tube measurements at the CMT monitoring locations. For clarity, the error bars are shown for the nearest CMT monitoring location only.

4.3.4.3 Analysis of the Gas Conductivity Values and Anisotropy Ratios

To verify the resulting K_{gs} values computed using Equation 3.1 and to assess the validity of the numerical modeling, an axisymetric numerical model was constructed using SEEP/W. This comparison was conducted for the results of the A and B vertical test series only. The model was constructed in a similar manner to those used to simulate the cross-hole data, however, a best-fit was determined based on a match of the simulated and measured pressure response in the test interval. The K_{gs} values computed using SEEP/W ranged from 9.5 x 10^{-5} to 4.2 x 10^{-6} m s^{-1} with a geometric mean of 1.7 x 10^{-5} ± 1.8 x 10^{-6} m s^{-1} (n = 114). The results of the numerical model and analytical solution are plotted in Figure 4.22. As can be observed, both interpretive techniques produce similar K_{gs} values for the single-hole data. However, the K_{gs} values computed using Equation 3.1 (geometric mean of 2.0 x 10^{-5} ± 2.4 x 10^{-6} m s^{-1}) were always slightly greater (the error increasing with K_g) than those determined using the numerical model (geometric mean of 1.7 x 10^{-5} ± 1.8 x 10^{-6} m s^{-1}), with an overall maximum error of 18 %.

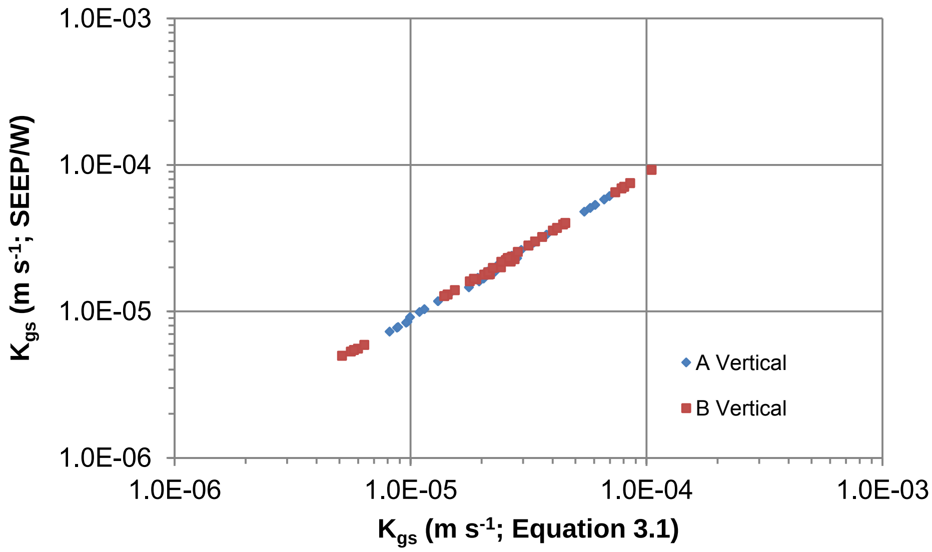

Figure 4.22 Comparison of K_{gs} values computed using Equation 3.1 and SEEP/W. The SEEP/W K_{gs} values are plotted on the y-axis with those from Equation 3.1 on the x-axis.

To verify the numerical modeling approach and to provide a check on analytical errors, the results of cross-hole test data were evaluated using both numerical modeling and Equation 3.2. For simplicity, k values determined using Equation 3.2 were not converted to an equivalent gas K_g. Rather the k values determined from the K_{gx} data were used for comparison, as these values had been calculated for the determination of K_l. The k values computed using Equation 3.2 and those approximated through numerical modeling are shown in Figure 4.23. A good correlation between the k values of Equation 3.2 and the numerical modeling results can be seen in Figure 4.23 (the data plots nearly 1:1 with an intercept close to 0). Dissimilar to the single-hole results, the analytical solution (geometric mean of 2.35 x 10^{-10} m^2) consistently produced k values that were smaller than those computed using the numerical model (geometric mean of 2.62 x 10^{-10} m^2).

Because no information regarding anisotropy can be obtained directly from a single-hole test, it was not considered in the numerical modeling analysis. However, the A_{gr} data (geometric mean for each test series ranged from 0.03 to 0.18) from the cross-hole tests suggest that the block is highly anisotropic. To determine the effect of neglecting anisotropy the single-hole numerical modeling results were reanalyzed for the 140909-A-Vert-4 test series using select anisotropy ratios determined from the cross-hole tests (the best-fit A_{gr} values for each test are provided in Appendix E). Inclusion of anisotropy (range of A_{gr} values used: 0.04 to 0.1) in the single-hole model resulted in an increase in K_{gs} of 1.4 to 1.6 with the greatest increase in K_{gs} corresponding with the smallest value of A_{gr}. It was concluded, therefore, that exclusion of anisotropy in the single-hole test analysis had a negligible effect on the results and was not considered further.

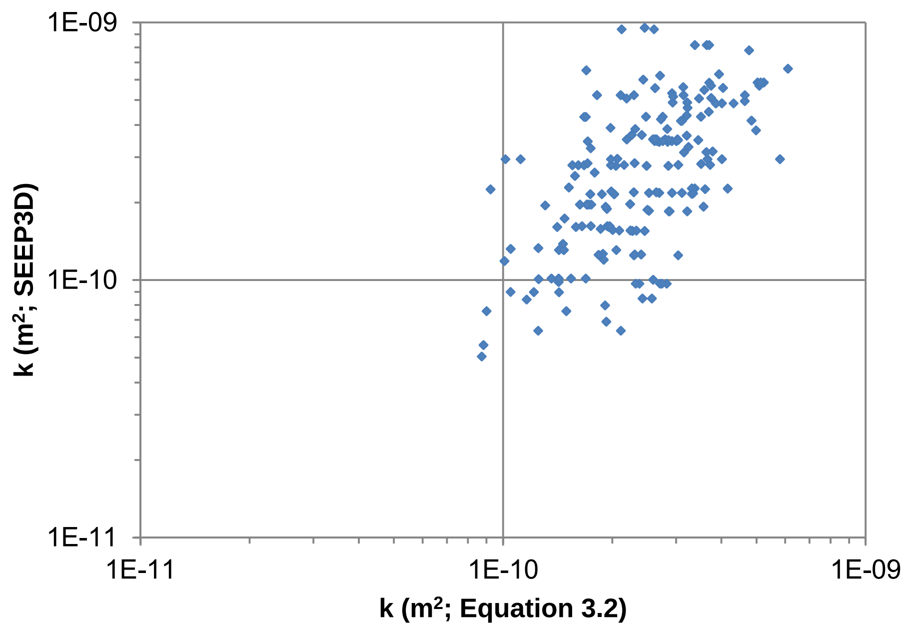

Figure 4.23 Comparison of k values computed using Equation 3.2 and numerical modeling. The k values from Equation 3.2 are plotted on the x-axis with the numerical modeling results plotted on the y-axis.

4.3.4.4 Relationship Between Conductivity and Fracture Spacing

The fracture spacing per test interval was compiled to determine if a relationship between the fracture density (inverse of spacing) and K_g could be defined. Various scenarios (i.e. vertical fractures only, horizontal fractures only, open fractures only, etc.) were considered in the assessment between fracture characteristics and K_g. Calculation of the fracture spacing over the entire length of the borehole allowed fractures beyond the test intervals to be included, such as those above and below the shallowest and deepest test depths. No relationship between the fracture density per test interval and the corresponding K_g (data not shown) was observed. Leven et al. (2004) and Rasmussen et al. (1995) noted similar findings and indicated that it may be invalid to estimate the transport properties of a medium based on fracture data alone.

4.3.4.5 Relationship Between Conductivity and Depth

The conductivity of a fractured medium typically decreases with depth and is usually associated with a decrease in the aperture size due to increasing overburden pressure (Louis, 1969; Zhao, 1998). Bonstrom (2007) noted a decrease of approximately two orders of magnitude for K_l values determined using hydraulic packer tests (K_b) for measurements approximately 9 mbss or greater, although, this may have been an artifact of the test method (Bonstrom, 2007) and borehole construction. A similar, albeit less rapid, decrease in K_g was observed with depth for the gas test data in the current study although, the greatest value of the geometric mean for the CV tests (180909-C-Vert-3) occurred at approximately 6 mbss (Figure 4.24). However, the standard deviation of the arithmetic data (σ_a) for this test ($\pm$ 2.3 x 10^{-4} m s^{-1}) was four times larger than the typical σ_a of the remaining C series tests ($\pm$ 5.3 x 10^{-5} m s^{-1}). In addition to a decrease in the magnitude of K_{gx} with depth there was an apparent reduction in the scatter of the K_{gx} values with depth for all of the tests.

Plots of K_{gy} and K_{gs} with depth are shown in Figures 4.25 and 4.26, respectively. Three (AV, CV, and CA) of the five test series for K_{gy} showed a decrease with depth. BV and BA appeared to increase with depth as the maximum K_{gy} values for BV and BA occurred between 6 to 10 mbss. However, these larger values were accompanied by the largest σ_a values. The σ_a value for the 230909-B-Vert-7 test (± 2.9 x 10^{-5} m s^{-1}) was greater than two times as large as the next largest σ_a value (± 1.4 x 10^{-5} m s^{-1}). No discernible pattern was observed between K_{gs} and depth. However, similar to the K_{gx} and K_{gy} data the maximum K_{gs} values occurred between 6 to 10 mbss.

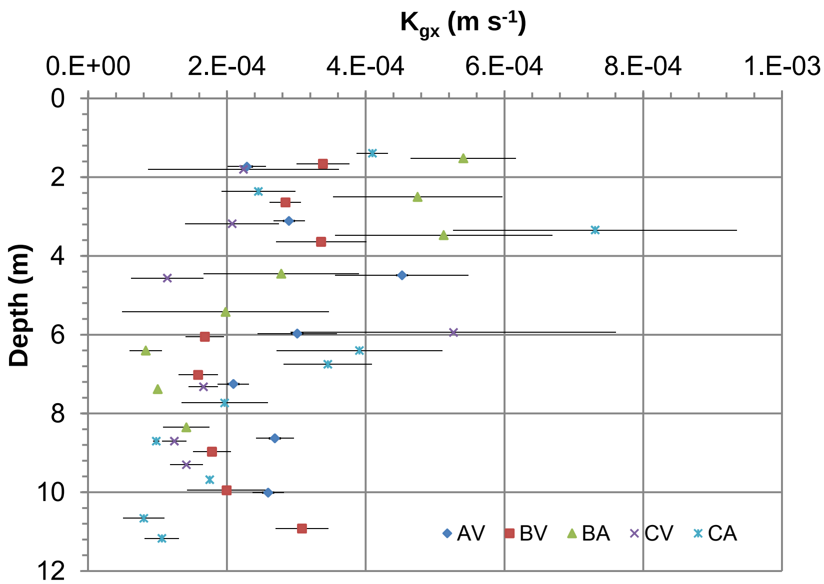

Figure 4.24 K_{gx} with depth below the surface of the block for each of the boreholes. The data represents the geometric mean of the K_{gx} values for each set of flow rates. For illustration purposes, one standard deviation (±; horizontal lines) of the arithmetic K_{gx} data is shown for each set of flow rates.

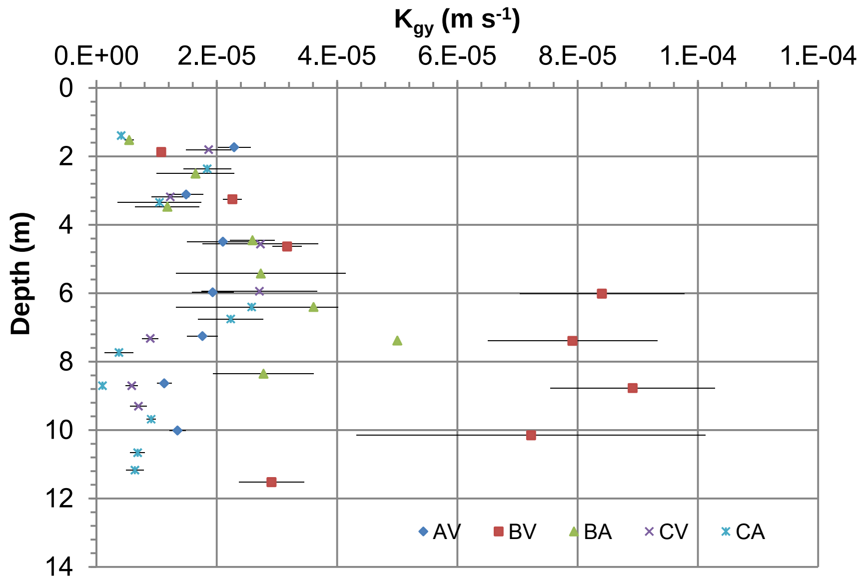

Figure 4.25 K_{gy} with depth below the surface of the block for each of the boreholes. The data represents the geometric mean of the K_{gy} values for each set of flow rates. For illustration purposes, one standard deviation (±; horizontal lines) of the arithmetic K_{gy} data is shown for each set of flow rates.

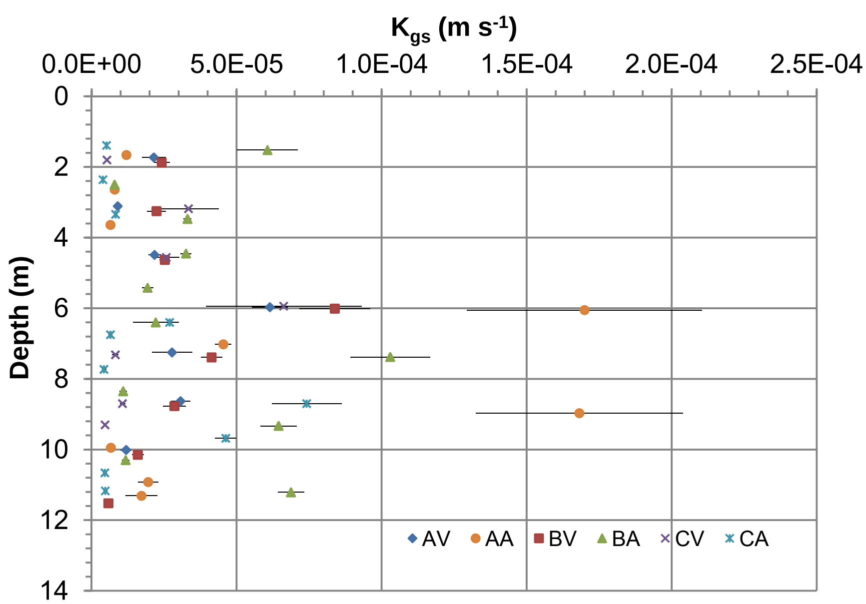

Figure 4.26 K_{gs} with depth below the surface of the block for each of the boreholes. The data represents the geometric mean of the K_{gs} values for each set of flow rates. For illustration purposes, one standard deviation (±; horizontal lines) of the arithmetic K_{gs} data is shown for each set of flow rates.

The A_{gr} values for each test series with depth can be seen in Figure 4.27. Although, a slight increasing trend was observed in the BV, BA, and CA series tests with depth, the remaining data was fairly consistent with depth as 78% of the total (n = 197) values were equal to or less than 0.2. There was also no noticeable difference in the A_{gr} values between the angled and vertical boreholes. Although, the purpose of the angled boreholes was to intercept a greater number of vertical fractures, in theory there should be no change in the anisotropy ratio.

4.3.5 Statistical Analysis of the Gas Conductivity Data

Statistical analysis of the single- and cross-hole data illustrated that the data was log normally distributed, typical of conductivity data (Neuman, 1987). The fit of the data to a log normal distribution was determined on the basis of the linearity of the probability plot (Figures 4.28 and 4.29), typically used to assess whether a data set is normally distributed (Filliben, 1975). As can be seen in both Figures 4.28 and 4.29 the log transformed K_g data was linear; the raw K_g data was not linear. Although, the log K_{gy} data could be considered linear, this trend was not as defined at the minimum and maximum extents of the data, whereas, the log transformed K_{gx} and K_{gs} data remained linear over the entire data range.

The Pearson correlation coefficient (r), was used to verify the visual assessment of the data's linearity. The coefficient r was computed for the Cunnane plotting position and the cumulative frequency function for a normal distribution for both the raw and log transformed data (Looney and Gulledge, 1985). The computed r values were compared to the tabulated r critical (r*) values of Looney and Gulledge (1985) based on sample size and a level of significance of 5 %. Each flow rate was considered in the calculation of K_g, however, in most instances the K_g value computed for each of the 5 flow rates varied only slightly. Therefore, r was calculated based on the group-averaged data (the mean of the individual K_g values determined for each of the 5 flow rates that comprised a test). A summary of the computed r and r* values for the K_g data is provided in Table 4.4.

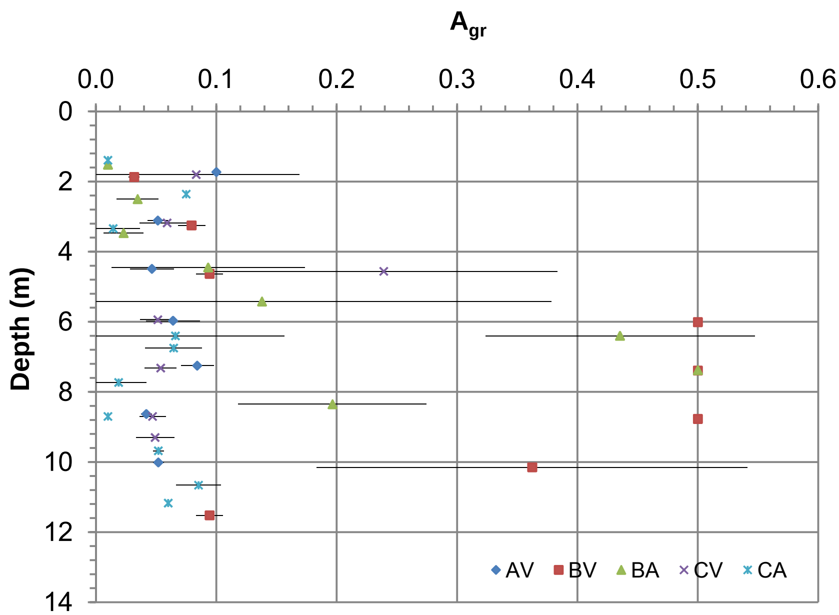

Figure 4.27 A_{gr} with depth below the surface of the block for each of the boreholes. The data represents the geometric mean of the A_{gr} values for each set of flow rates. For illustration purposes, one standard deviation (±; horizontal lines) of the arithmetic A_{gr} data is shown for each set of flow rates.

It can be seen from Table 4.4 that the K_{gx} and K_{gy} values for each of the tests were always considered to be log normally distributed. All of the data sets for K_{gs} were also log normally distributed with the exception of AA and CA. When all of the data is considered together K_{gx}, K_{gy}, and K_{gs} are all considered to be log normally distributed. The K_{gx} (skew = -0.04) and K_{gy} (skew = -0.46) data were slightly skewed to the right indicating a small percentage of the K_g values were much larger than the mean. This is the case for both the raw and log-transformed data. However, the K_{gs} (skew = 0.25) and A_{gr} (skew = 0.15) data are skewed to the left.

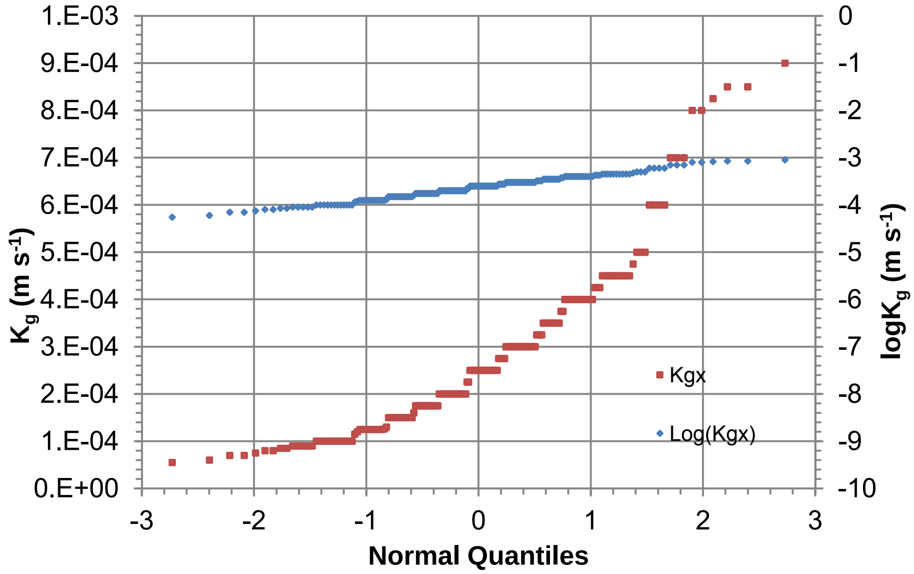

Figure 4.28 Probability plot (z-score) of the K_{gx} data. Log transformed K_{gx} data is plotted on the secondary vertical axis. Both the raw and log transformed K_{gx} data are plotted against the z-score.

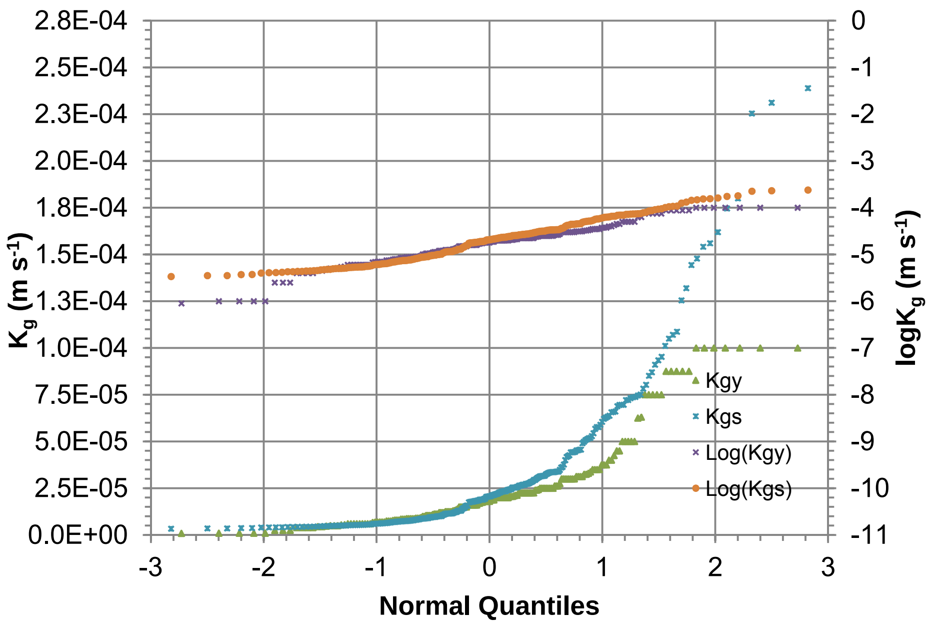

Figure 4.29 Probability plot (z-score) of the K_{gs} and K_{gy} data. Log transformed data is plotted on the secondary vertical axis. Both the raw and log transformed K_g data are plotted against the z-score.

Table 4.4 Summary of the probability plot correlation coefficient for the group averaged data. n is the number of values considered for each test and the Normality defines if the data set(s) can be considered normally distributed.

		Group Averaged Data				
Test Series	K_g Type	n	r		r* (a=0.05)	Normality
-	-	-	K_g	$\log K_g$	-	-
AV	K_{gx}	7	0.871	0.905	0.898	LogK_g
	K_{gy}	7	0.990	0.987	0.898	Both
	K_{gs}	7	0.916	0.979	0.898	LogK_g
AA	K_{gx}	-	-	-	-	-
	K_{gy}	-	-	-	-	-
	K_{gs}	10	0.854	0.887	0.918	Neither
BV	K_{gx}	8	0.940	0.940	0.906	Both
	K_{gy}	8	0.929	0.942	0.906	Both
	K_{gs}	8	0.886	0.958	0.906	LogK_g
BA	K_{gx}	8	0.951	0.965	0.906	Both
	K_{gy}	8	0.989	0.958	0.906	Both
	K_{gs}	11	0.945	0.982	0.923	Both
CV	K_{gx}	7	0.839	0.927	0.898	LogK_g
	K_{gy}	7	0.942	0.968	0.898	Both
	K_{gs}	8	0.868	0.955	0.906	LogK_g
CA	K_{gx}	10	0.926	0.985	0.918	Both
	K_{gy}	10	0.953	0.964	0.918	Both
	K_{gs}	10	0.822	0.901	0.918	Neither
All Data	K_{gx}	40	0.952	0.994	0.972	LogK_g
	K_{gy}	40	0.875	0.979	0.972	LogK_g
	K_{gs}	54	0.814	0.984	0.979	LogK_g

The distributions for the log transformed K_{gx} and K_{gs} conductivity data are shown in Figures 4.30 and 4.31, respectively. SigmaPlot (Systat Software Inc., 2013) was used to plot the histograms for the log transformed data (Figures 4.30 and 4.31). The histograms for each data set were not used in the determination of the respective distributions and are plotted alongside the distributions in Figures 4.30 and 4.31 for comparative purposes only. The K_{gs} data can be seen to fit a log normal distribution quite well. The K_{gs} data appears reasonably matched by the log normal distribution but appears to be bimodal (discussed in Section 4.4.3). The appearance of bimodality may be caused by the skew of the K_{gs} data being to the left or a greater percentage of the data being smaller than the mean.

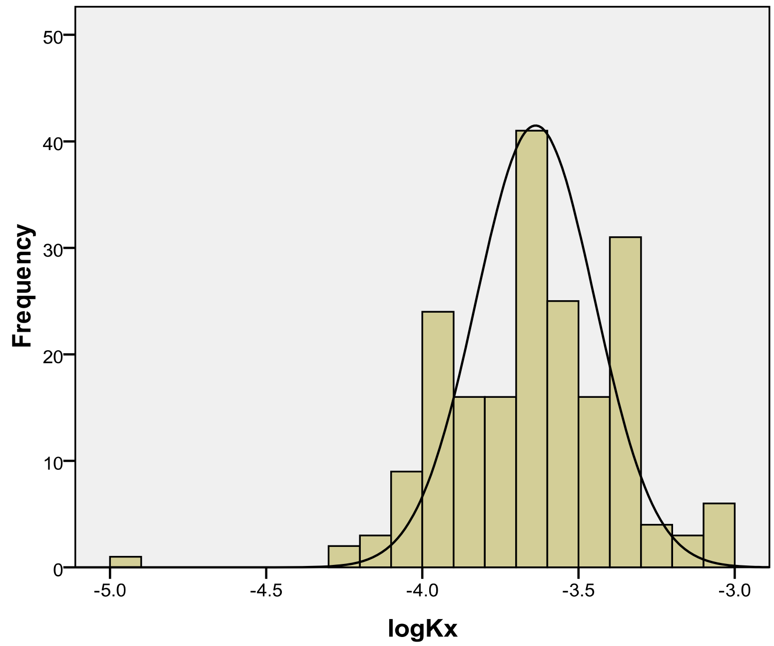

Figure 4.30 Histogram of log K_{gx} values for all cross-hole test data (n = 197). The frequency represents the number of occurrences of a conductivity value within the ranges specified on the x-axis.

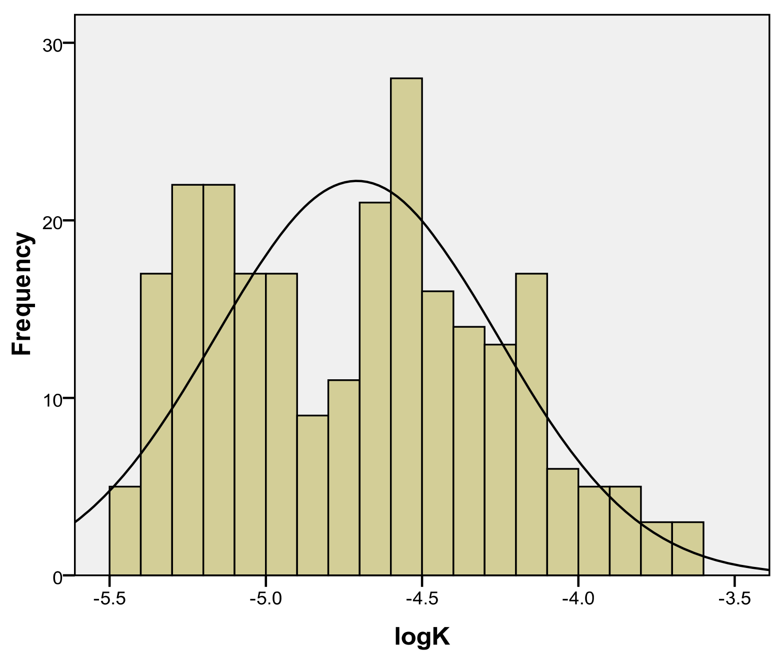

Figure 4.31 Histogram of log K_{gs} values for all single-hole test data (n = 261). The frequency represents the number of occurrences of a conductivity value within the ranges specified on the x-axis.

A t-test was used to compare the geometric means of the log-transformed data between the various test groups and the results are summarized in Table 4.5. A pass indicated that the geometric means of the two samples were not considered to be statistically different. Based on the results of the t-tests the geometric means of the individual tests could not all be considered statistically similar. All of the angled tests (excluding AA) have statistically similar geometric means when compared to each of the test series. However, when comparing the means of the vertical test series none could be considered to be of the same population. This would imply that the conductivity values determined from any of the vertical boreholes were only representative of the location from which they were determined. A box plot was constructed for the K_g data (Figure 4.32). The box plot illustrated that the range of the conductivity values from the vertical boreholes was in general much smaller than that of the angled boreholes; however, the most notable characteristic was the significantly reduced interquartile range of the vertical boreholes (largest vertical borehole interquartile range [BV]: 1.8×10^{-4} to 3.0×10^{-4} m s^{-1}) in comparison to the angled boreholes (smallest angled borehole interquartile range [CA]: 1.3×10^{-4} to 4.0×10^{-4} m s^{-1}). The failure of the proposed t-test hypothesis (means could be considered to be of the same population) for the vertical borehole tests, may have been the result of the small spread in the vertical conductivity data. Although from a statistical standpoint the conductivity of the vertical boreholes could not be considered to be of the same 'population', the box plots illustrate that the conductivity is highly consistent throughout the block.

4.3.6 Verification of the Flow Regime

Due to the differences in K_g obtained from the single- and cross-hole tests, it was hypothesized that some of the underlying assumptions used in the analysis of K_g may be invalid. It was assumed in the analysis that changes in gas volume with pressure could be ignored, that the relationship between pressure and flow rate was linear, and that the flow remained laminar.

Although, studies have been conducted to test the applicability of water flow models as a means to estimate gas flow (Massmann, 1989), many assumptions were required and must be validated. For example, in the vicinity of a pumping well the convergence of the flow may cause significant increases in the velocity and generate non-laminar flow conditions (Kalaydlian et al., 1996; Holditch and Morse, 1976). This behavior is further accentuated by the fractured nature of the flow system since a few highly conductive fractures may be responsible for a large percentage of the flow resulting in large gas velocities.

Table 4.5 Summary of t-test on the K_{gx} data for the individual test series. Reject or pass is used to identify if the test series in the top row can be considered statistically similar to the test series listed in the left most column. A '-' indicates that the test series could not be compared because they are identical data sets.

Test Series	AV	BV	BA	CV	CA
AV	-	reject	pass	reject	pass
BV	reject	-	pass	reject	pass
BA	pass	pass	-	pass	pass
CV	reject	reject	pass	-	pass
CA	pass	pass	pass	pass	-

In addition to significant differences in the means of the single- and cross-hole K_g values, differences in the measured and simulated drawdown within the test interval were observed. Theoretically, the ratio of the simulated and measured pressure response at the borehole should be equivalent but, as can be observed in Figures 4.33 and 4.34, this ratio was much greater than 1 and increased with flow rate. It was hypothesized that the incongruence between the simulated and measured pressure in the test interval could be attributed to skin effects, the onset of turbulent flow in the vicinity of the borehole, or both. In addition, differences between K_{gs} and K_{gx} may be due to scale effects (Illman, 2006). Illman (2006) noted differences in the conductivity determined using single- and cross-holes test data and attributed this to the fact that single-hole tests will produce K values representative of the material adjacent to the test location only. Cross-hole tests may identify more conductive fractures beyond the test location and will account for the flow and the associated losses through these conductive passages. Although, the effect of test scale on K_g was assessed in this study, differences in the single- and cross-hole K_g data as a result of scale were not considered.

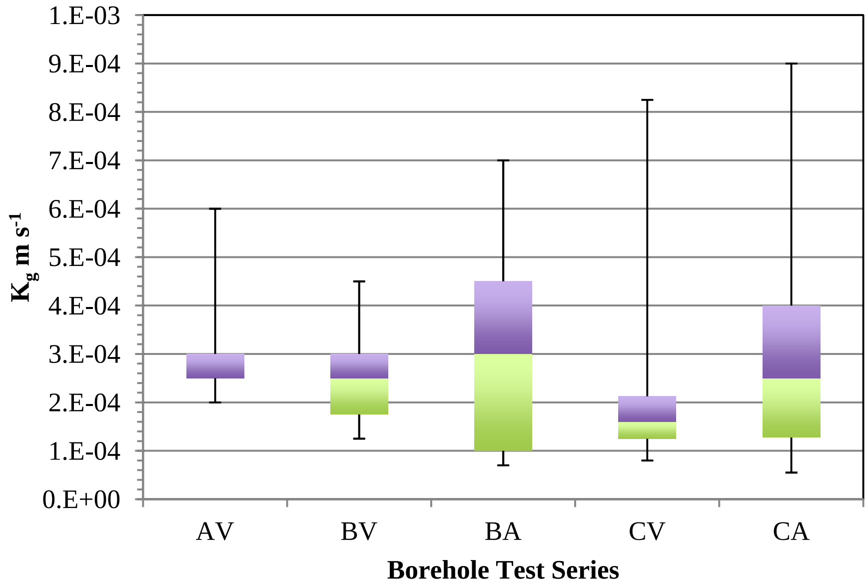

Figure 4.32 Boxplot of K_{gx} values for all cross-hole test data (n = 197). The purple and green boxes represent the data that falls within the 75th and 25th percent quartiles, respectively. The intersection of the purple and green boxes represents the median of the data for each borehole. The error bars represent the minimum and maximum values of the K_{gx} values for each borehole.

4.3.6.1 Skin Effects

Skin effects refer to the clogging of fractures with fine dust or the closing of the fractures and conductive pore spaces on the borehole annulus as a result of disturbances caused by drilling. Hypothetically, skin effects should increase the resistance of S^o block by an amount proportional to the flow rate. Because the resistance through the S^o block and skin should both increase by an equal proportion with increasing flow, the ratio of the two should remain constant at all flow rates.

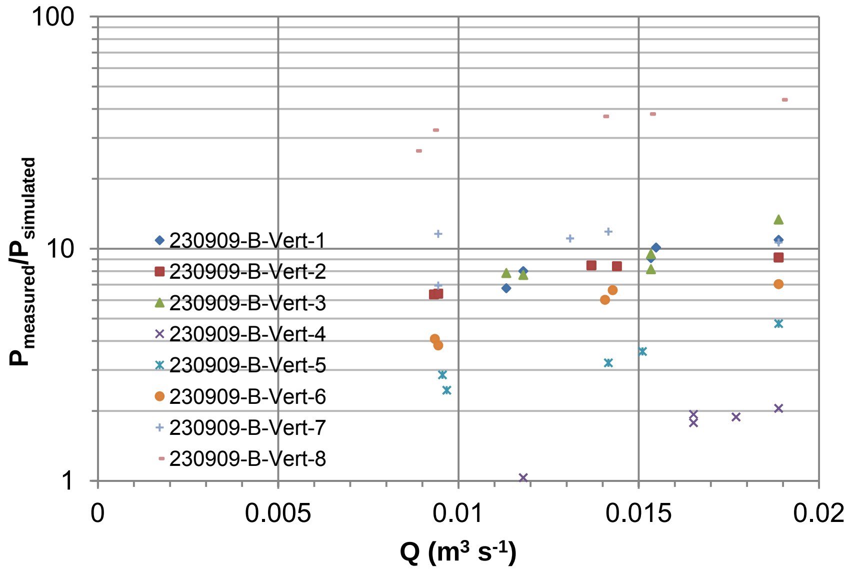

Figure 4.33 Ratio of the measured and simulated drawdown at the borehole versus flow rate for the B vertical test series.

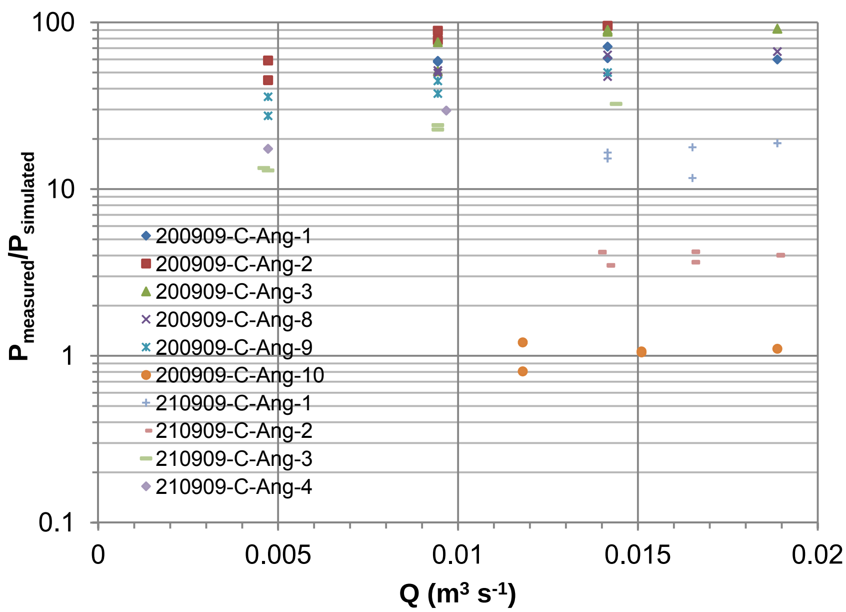

Figure 4.34 Ratio of the measured and simulated drawdown at the borehole versus flow rate for the C angular test series.

A simple numerical model was developed using SEEP/W to assess whether a thin layer of lower conductivity could be capable of producing the observed differences between the simulated and measured drawdown. The conductivity for an assumed skin thickness was computed using the steady-state radial well flow equation (Houghtalen et al., 2009):

$$K_s = \frac{Q \ln\left(\frac{r_s}{r_m}\right)}{2\pi L_T \left(h_s - h_m\right)} \qquad [4.1]$$

where K_s is the conductivity of the skin layer (m s^{-1}), Q is the measured gas flow rate (m^3 s^{-1}), r_s and r_m are the distances from the center of the borehole to the outermost edge of the skin and the borehole wall respectively (m), and h_s and h_m are the simulated and measured pressure head (m of gas) at the skin edge and the borehole wall, respectively. The value of h_s was back calculated from the simulations once a best-fit to the pressure response at the monitoring intervals had been achieved and h_m is the measured pressure within the test interval for the same test.

The mean computed values of K_s for skin thicknesses of 1 and 10 mm were 3.1 x 10^{-7} and 3.3 x 10^{-6} m s^{-1}, respectively and would have the same hydraulic resistance. The conductivity of the 1 mm skin was within the range of the matrix conductivity 6.8 x 10^{-7} m s^{-1} obtained by Bonstrom et al. (2009) after conversion to an equivalent K_g. A 1 mm skin may seem unrealistically thin; yet the presence of a 10 mm skin should be visible to the naked eye unless the material was concealed within the fractures or damage to the surface of the fractures could not be identified from the borehole videos. However, fractures observed during borehole video logging appeared to be clear of debris with no signs of visible damage.

The numerical model was constructed similarly to those used to compute K_g, however, measured properties were used in the model. The S^o conductivity was defined as the value obtained during cross-hole field-testing. The simulated results verified that the ratio between the simulated and measured drawdown would remain constant with increases in flow rate. The ratio produced for the modeled case was 4.2. This suggests that skin effects could only partially explain differences between the simulated and measured drawdown because it cannot explain increases in the head loss ratio with flow rate.

4.3.6.2 Transition from Laminar to Turbulent Flow

Another possible explanation for the differences between the estimated and measured drawdown could be the onset of turbulent flow. Laminar (or Darcian) flow conditions require that the fluid velocity is low enough for the dominant form of head loss to be due to fluid viscosity such that the pressure drop is proportional to the flow rate. Research in the areas of oil and gas production have shown that at high velocity the pressure drop may be underestimated by a linear relationship and it is hypothesized that such behavior is due to the onset of turbulence. Neglecting these 'non-Darcian' effects would lead to an under estimation of the conductivity (Guppy et al, 1982).

To assess whether the flow in the vicinity of the borehole had transitioned from laminar to turbulent during the pumping tests the Re number was used. Calculation of the Re number required an estimation of the effective aperture of the fractures (methodology explained in Section 3.6.5) and was obtained using the fracture spacing data obtained from fracture mapping studies conducted on the Phase 1 block (Table 4.2) and the field measured K_{gx} values. The arithmetic mean horizontal fracture spacing was assumed to be 0.16 m. This corresponds to 9 horizontal fractures per 1.38 m test interval for the vertical boreholes and approximately 5 for the angled boreholes. The resulting effective apertures ranged from 2.6 to 6.7 mm with an arithmetic mean of 4.3 mm.

The resulting vertical apertures were calculated using the slightly different methodology explained in Section 3.6.5. The calculated effective vertical apertures ranged from 0.20 to

1.16 mm with an arithmetic mean of 0.63 mm. Based on the video logs the difference between the effective aperture of the open horizontal and vertical fractures of approximately 5 times appears reasonable.

The values of Re numbers for all of the tests are shown in Figure 4.34. Re values for horizontal fractures ranged from 243 to 906 with an arithmetic mean of 508. Re numbers for the vertical fractures were much smaller than that of the horizontal fractures ranging from 15 to 219 with an arithmetic mean of 81 (data not shown).

A review of literature in the area of fracture flow fluid mechanics indicated that there is a range of opinions in regards to the value of the Re_c. However, the most commonly referenced work is that of Louis (1969), Romm (1966), and Lomize (1951) [the latter two references were not reviewed in this study]. These authors suggest that the onset of turbulent flow will occur at a Re_c value of approximately 1200. Van Golf-Racht (1982) reported similar findings indicating that the onset of turbulent flow would begin at a Re_c of approximately 1000 for gas flow. An important caveat in defining Re_c is that it is not constant, as suggested by some authors, but will decrease with increasing surface roughness (Louis, 1969). Other factors, such as variable aperture and fracture constrictions will also cause irregularities in the flow field. In this study it was assumed that all fractures were ideal, smooth walled, and of constant aperture. No quantitative data were available on fracture irregularities or the effects of surface roughness.

This analysis suggested that the flow into the borehole was generally below Re_c values representing the start of turbulent conditions and consequently the assumption of laminar flow was appropriate. However, the Re values approached Re_c limits at the highest flow rates. Given that the fractures were likely rough and irregular it is suggested that non-laminar conditions may have developed at the highest flow rates and K_g conditions. In addition, the effective aperture was determined using the mean fracture spacing and therefore, in some tests, the number of fractures contributing to the flow may have been overestimated resulting in low estimates of the fracture velocity. In these cases the actual Re could be much larger and exceed Re_c. Even if Re_c was not exceeded, it is suggested that non-linear pressure losses may occur prior to Re_c (Al-Yaarubi et al., 2005). It is possible that irregularities in the flow regime are responsible for the discrepancies between the simulated and measured test interval pressure and K_{gs} and K_{gx}.

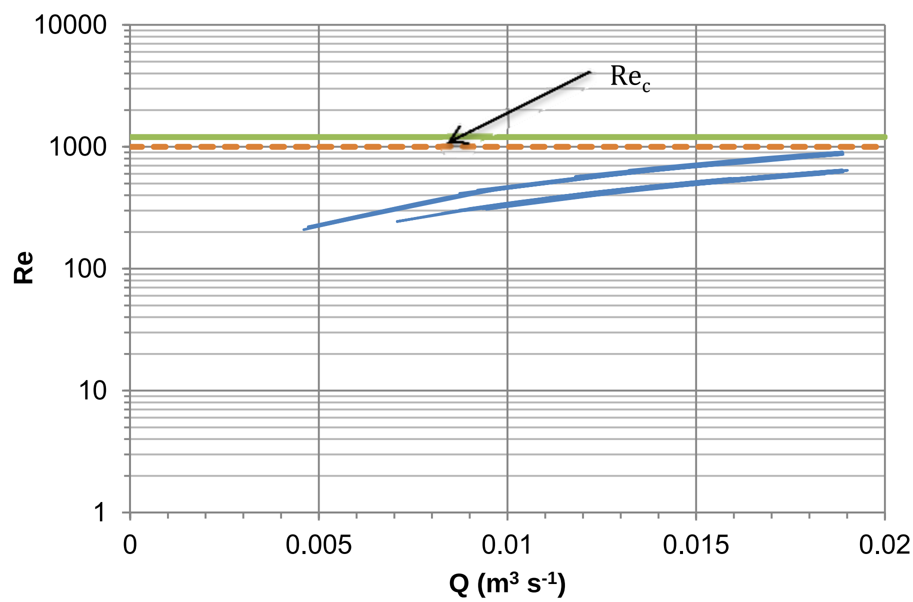

Figure 4.35 Re versus Q for the horizontal fractures for all of the K_g test data. The orange dashed line and green solid line represent the Re_c values suggested by Van Golf-Racht (1982) and Louis (1969), respectively.

4.3.6.3 Correction of Non-Darcian Effects

To account for pressure losses that may develop due to inertial effects it is suggested an additional term relating the pressure losses to velocity squared be included in the calculation of the pressure losses (Lecain, 1998 and Thauvin and Mohanty, 1998):

$$-\frac{dp}{dx} = \frac{\mu V}{K} + \rho \beta V^2 \qquad [4.2]$$

where dp is the differential pressure (Pa) for the differential length dx (m), and β is a constant representing non-Darcian flow (Pa). However, at some distance from the wellbore the velocity would be much less and the second term of Equation 4.2 would be negligible (Thauvin and Mohanty, 1998). Therefore, it would seem plausible that such non-Darcian effects could be neglected in regards to the cross-hole test data and may produce more representative estimations of the K_g.

For single-hole multiple flow rate tests, Lecain (1998) illustrated that a plot of the difference between the squared injection and steady-state pressures ($\Delta[P_{ss}^2 - P_o^2]$ – abbreviated as ΔP^2) versus the flow rate may identify those tests where turbulent flow exists and would be indicated by an upward curvature (Figure 4.36). Lecain (1998) modified Equation 3.1 by replacing the delta pressure squared and flow rate terms with a constant that could be determined by extrapolation to the y-axis on a plot of $\Delta P^2/Q$ versus Q. Lecain (1998) indicated that the use of such a procedure would allow a Darcian type flow solution to be valid under non-linear flow conditions because as Q approaches zero the pressure loss to flow relationship would be linear. The modified relationship of Lecain (1998) is:

$$k = \frac{P_{ss}\mu \ln\left(\frac{L_T}{2r_w} + \sqrt{1+\left(\frac{L_T}{2r_w}\right)^2}\right)T}{\pi L \beta T_{sc}} \qquad [4.3]$$

Plots of ΔP^2 versus flow rate were reviewed (Appendix E) and where an upward curvature was identified (Figure 4.36), Equation 4.3 and the graphical method suggested by Lecain (1998) were used to determine an adjusted K_{gs} value. The original and adjusted K_{gs} values, corresponding K_{gx} values, and the ratio of K_{gx} to the original and adjusted values of K_{gs} are summarized in Table 4.6. Both the original and Lecain adjusted K_{gs} values are plotted against the K_{gx} values in Figure 4.36. It can be seen in Table 4.6 and Figure 4.37 that the adjustment procedure reduced the error between K_{gs} and K_{gx}, to varying degrees, for all of the tests with the exception of 220909-B-Ang-7, 200909-C-Ang-10, and 210909-C-Ang-2.

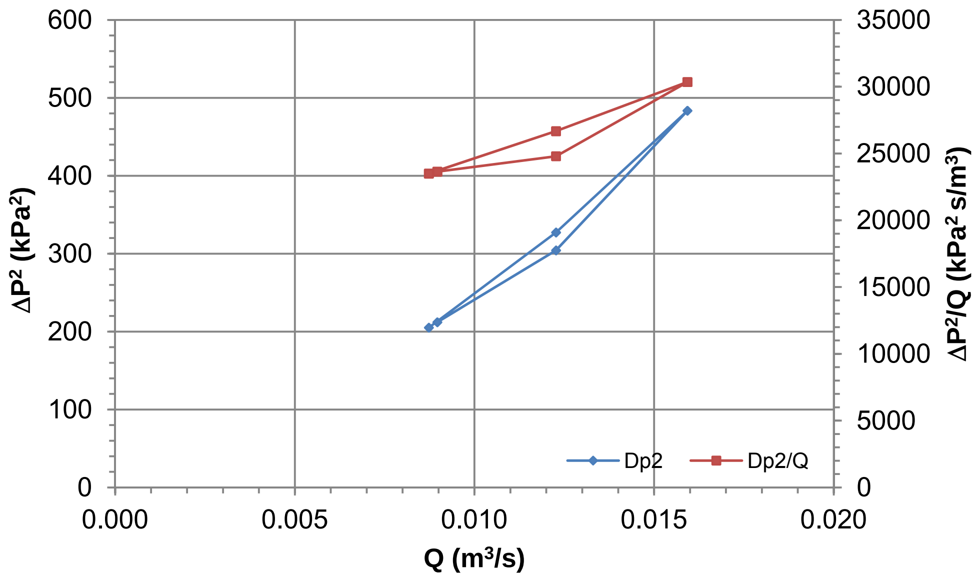

Figure 4.36 ΔP^2 and $\Delta P^2/Q$ versus Q for A series test 150909-A-Vert-1. The legend item Dp2 refers to difference between the squared injection and steady-state pressures (abbreviated during earlier discussion as ΔP^2).

4.3.7 Influence of Scale Effects on Conductivity

A large breadth of studies indicate K is scale dependent (Rasmussen et al., 1993; Rovey and Cherkauer, 1995; Illman and Neuman, 2003; Illman, 20006; Freeze and Cherry, 1979; Schulze-Makuch et al. 1999). There is however, disagreement as to whether such scale effects are manifested due to:

1) dissimilarity between test methods (Hsieh, 1998; Hunt, 2003);
2) differing analytical techniques (Hunt, 2003); or
3) analysis of data from tests conducted on a material with numerous subunits of differing geological properties (Rovey and Cherkauer, 1995).

In this study potential scale effects were assessed by the use of several test interval lengths: 0.37, 1.38, 2.39, and 2.90 m. Each test interval length was applied at two different depths. The depths were chosen based on locations where an adequate pressure response had been observed for several adjacent tests. This was necessary to ensure that a measureable response could be observed within the capacity of the applied vacuum, as it was envisioned that the largest interval would require a substantially larger applied flow rate.

Table 4.6 Summary of the original and adjusted K_{gs} values, K_{gx}, and the ratio of K_{gx}/K_{gs} for both original and adjusted K_{gs} data.

Test ID	K_{gx} (x 10^{-5} m s^{-1})	K_{gs} [1] (x 10^{-5} m s^{-1})	K_{gs} [2] (x 10^{-5} m s^{-1})	K_{gx}/K_{gs} [1]	K_{gx}/K_{gs} [2]
140909-A-Vert-3	46.0	2.2	2.5	21	19
140909-A-Vert-4	30.5	6.2	7.7	5	4
150909-A-Vert-1	27.0	3.1	5.6	9	5
230909-B-Vert-1	34.0	2.4	4.8	14	7
230909-B-Vert-3	34.0	2.5	3.9	13	9
230909-B-Vert-4	17.0	8.4	33.7	2	1
230909-B-Vert-5	16.0	4.1	6.2	4	3
230909-B-Vert-6	18.0	2.9	5.2	6	3
230909-B-Vert-8	31.0	0.6	0.8	54	40
220909-B-Ang-1	54.5	6.1	12.8	9	4
220909-B-Ang-3	53.0	3.3	4.6	16	11
220909-B-Ang-4	30.0	3.3	5.5	9	5
220909-B-Ang-5	24.1	1.9	3.5	12	7
220909-B-Ang-6	8.5	2.3	6.5	4	1
220909-B-Ang-7	10.0	10.4	19.9	1	1
220909-B-Ang-8	14.4	1.1	1.7	13	9
240909-B-Ang-1	---	6.5	1.8	---	---
240909-B-Ang-2	---	1.2	19.8	---	---
240909-B-Ang-3	---	6.9	15.0	---	---
090909-C-Vert-1	25.5	0.5	0.7	49	35
180909-C-Vert-3	56.5	7.0	97.2	8	1
180909-C-Vert-4	16.7	0.8	1.3	20	13
2009090C-Ang-1	41.0	0.5	0.6	80	68
2009090C-Ang-2	25.0	0.4	4.4	64	6
2009090C-Ang-8	35.0	0.7	4.4	54	8
2009090C-Ang-9	20.5	0.4	4.4	48	5
2009090C-Ang-10	9.8	7.5	4.5	1	2
2109090C-Ang-1	41.0	2.7	4.4	15	9
2109090C-Ang-2	17.5	4.6	4.4	4	4

Notes:

- Subscript 1 indicates that K_{gs} is the original value.
- Subscript 2 indicates K_{gs} has been adjusted based on the procedure of Lecain (1998).

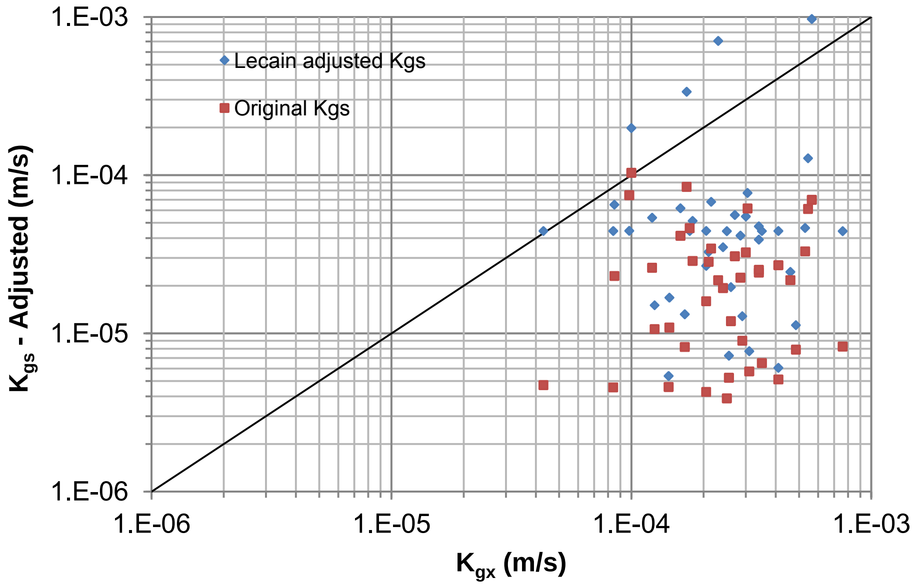

Figure 4.37 Plot of the unadjusted and adjusted K_{gs} values versus K_{gx}. Data plotted on the solid black line indicates K_{gs} and K_{gx} results that are equivalent.

The location of the tests corresponded to the B angular series tests at depths of 2.5 mbss (220909-B-Ang-2) and 8.35-mbss (220909-B-Ang-8), as both depths and the surrounding tests showed relatively strong responses. Due to the high fracture frequency and relatively short spacing of the fractures, it was deemed impractical to attempt to use interval lengths small enough to differentiate between the fractured and matrix pore spaces. The equivalent K_g of the K values reported by Bonstrom (2007) for intact core samples are included for comparison.

Schulze Makuch et al. (1999) summarized several methods suggested for estimation of the measurement scale including fluid travel distance, radius of influence, and test volume. In this study (this thesis), the scale was taken to be the test volume affected by the pumping test. The change in affected volume between different test interval lengths was approximated using a numerical model constructed with SEEP/W. The use of SEEP/W (an EPM solution) to approximate the change in volume was assumed valid due to the highly fractured nature of the block and due to the close spacing of the fractures. The numerical model was constructed identically to those used to determine K_g from the packer test data. Several models were constructed with various test interval lengths corresponding to those used in the field with the center of the test interval as a datum between the models. Identical boundary conditions and material properties were maintained between the models.

A minimum pressure head contour (-0.02 m) in the SEEP/W model was selected as representing the extent of the affected test volume. From visual inspection the shape of the pressure head contours resembled that of an ellipse. The volume was calculated assuming the pressure head contours were axisymmetric about the borehole axis. The volume was computed using the equation of an oblate spheroid, which is an ellipsoid where the polar radius (axis parallel to the borehole) is less than the equatorial radius (axis perpendicular to the borehole).

The relationship between K_g and scale (test volume) is illustrated in Figures 4.38 through 4.39. The core conductivity calculated by Bonstrom (2007) was included in the best-fit lines of Figure 4.38. The volume of the core sample was approximated using the relationship between the SEEP/W test volume and the length of the various test intervals used in the field (data not shown). For the shallow tests a linear function best described the relationship between scale and K_g when the core sample was excluded from the analysis. When the core sample was included, a power function produced a best-fit between K_g and the test scale. For the deeper tests, a linear function best described the relationship between K_g and scale whether the core sample data was included or not.

Schulze-Makuch et al. (1999) suggested that the increase in K with test scale could be expressed as a power law:

$$K = cV^m \qquad [4.4]$$

where c is an intercept of the regression line at a test volume of 1 m^3, V is the effected test volume, and m a scaling exponent.

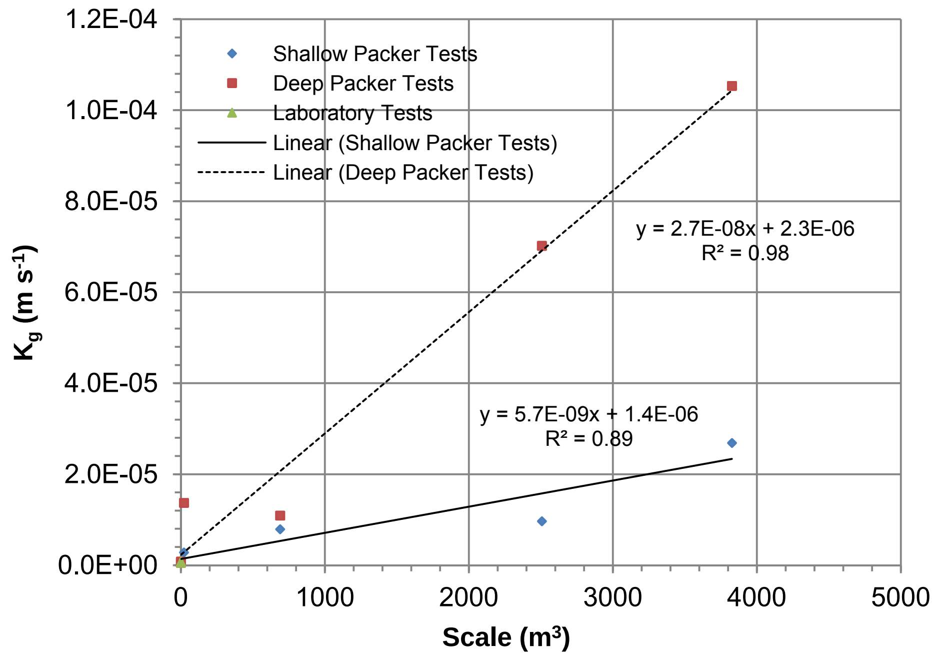

Figure 4.38 Relationship of K_{gs} to the scale of measurement. The scale is taken as the test volume approximated from the SEEP/W models. The solid and dotted lines represent linear regression functions for the shallow and deeper packer tests, respectively.

A power law function, similar to Equation 4.4, produced a reasonable fit to the K_g and scale data from this study but underestimated K_g for larger test volumes (Figure 4.39). The resulting power law functions (Figure 4.39) were $K_g = 1.6 \times 10^{-6} V^{0.3}$ and $K_g = 2.7 \times 10^{-6} V^{0.4}$ for the shallow and deeper packer tests, respectively. The scaling factors, c, in this study were greater than the mean values reported by Schulze-Makuch et al. (1999) for fracture-flow systems (1 x 10^{-7}) while the exponent was below the typical range of values reported by Schulze-Makuch et al. (1999) [0.80 to 1.13]. Variance between the scaling factors and exponents reported in this study and those of Schulze-Makuch et al. (1999) may be due to the test volume selected in this study not being representative of the true affected volume.

For comparison, the relationship between K_g and screen length was also evaluated (Figure 4.40). A power law function was used to describe the relationship between screen length and K_g as it has been illustrated that the relationship between scale and K_g typically follows such a relationship (Schulze-Makuch et al., 1999). The power law functions describing the relationships between both K_g to test volume and screen length were used to approximate a screen length that may have produced a K_g value corresponding to the matrix conductivity values of Bonstrom et al. (2009). Based on the power law functions for K_g to volume, a test interval length of between 0.01 and 0.03 m may have resulted in a reported K_g value similar to that of the matrix, for the deep and shallow packer tests, respectively. Based on the linear relationship between screen length and K_g, a test interval length of between 0.03 to 0.08 m would produce a K_g value similar to that of the matrix. The calculated screen lengths with the potential to produce K_g values on the order of the block matrix seemed reasonable based on the mean measured fracture spacing of the closed fractures of 0.05 m and open fractures of 0.16 m.

Similar findings regarding test interval length (scale) and K were reported by Hendry (1982) based on the study of a glacial till. Hendry reported two fracture scales each with different fracture spacings. The small-scale fractures were reported to have a fracture spacing of approximately 10 mm whereas the large-scale fracture spacing ranged from 20 to 630 mm. Congruence between the fracture scales and conductivity was supported by statistically larger conductivity values on core samples containing fractures with characteristics similar to the large-scale fractures observed during physical investigation. Cores containing only characteristics of small-scale fractures were of much lower conductivity. Hendry (1982) indicated that field tests with screened intervals of 1.5 m comprised the highest conductivity values, whereas the conductivity of the smaller 0.5 m screened intervals was typically less. Hendry (1982) suggested that the reasoning for this was because only the 1.5 m test intervals were large enough to encompass the entire range of fracture spacing's of the larger scale fractures.

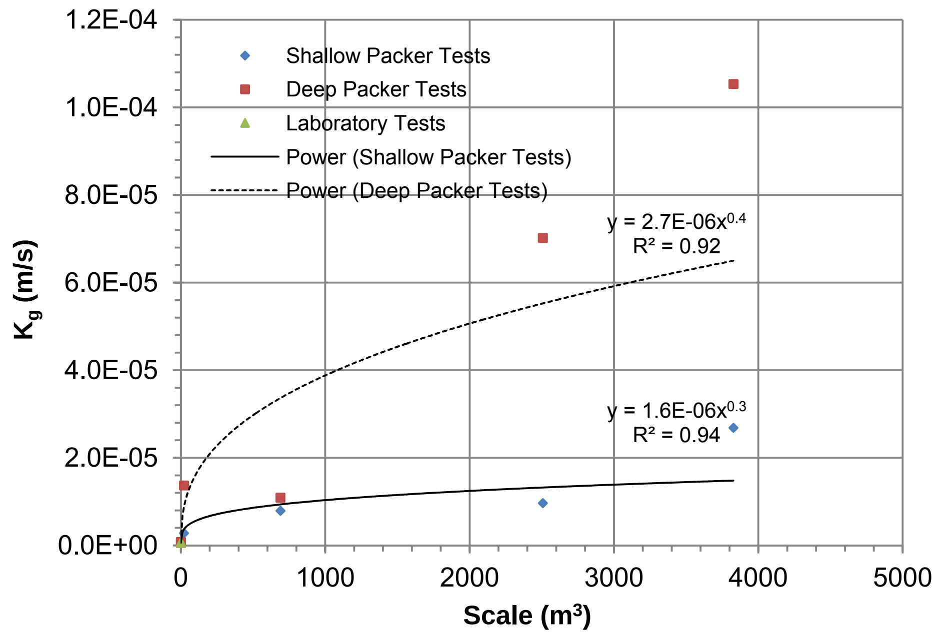

Figure 4.39 Relationship of K_{gs} to the scale of measurement. The scale is taken as the test volume approximated from the SEEP/W models. The solid and dotted lines represent power regression functions for the shallow and deeper packer tests, respectively.

A similar relationship to that shown in Figure 4.40 was found by Keller et al. (1988) who explained that an observed increase in K with increasing screen length was due to the intervals of smaller length not intersecting hydraulically conductive fractures. Based on the relationship between screen length and conductivity, Keller et al. (1988) suggested, in their study, that for a screen length of greater than 1 m, the resulting K values could be considered representative of the bulk conductivity. However, Keller et al. (1998) noted that the requirement for a screen length of 1 m was in contrast to the visual fracture spacing data presented by Keller et al. (1986) in which horizontal and vertical fractures were identified at a spacing of approximately 10 mm. Keller et al. (1988) hypothesized that a more conductive set of fractures was responsible for the discrepancy between the visual fracture spacing and the larger conductivity values for larger screened intervals.

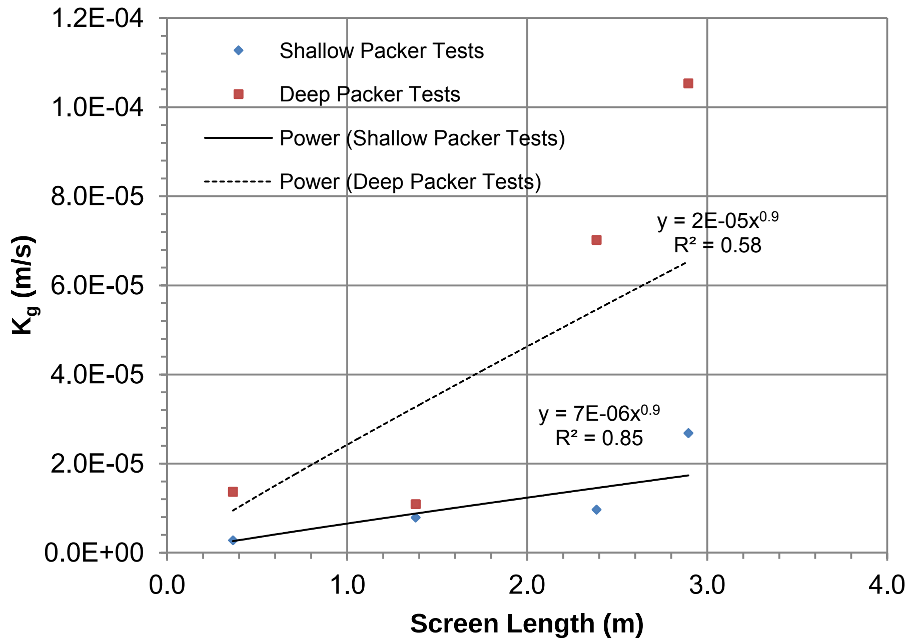

Figure 4.40 Relationship between screen length and K_g. The solid and dotted lines represent linear regression functions for the shallow and deeper packer tests, respectively.

Based on the fracture spacing measured in this study and also by Bonstrom (2007) and McKenna (2004a), it would was anticipated that an upper bound on K_g would have been obtained at a scale less than that of the smallest test interval length (0.37 m). For a test interval length of 0.37 m, at least one open and several closed fractures would have been intersected given the measured open and closed fracture spacing of 0.16 and 0.05 m, respectively. However, based on the findings of Hendry (1982) and Keller et al., (1988), there may be specific fractures or fracture sets, at a greater spacing, that control fluid conductance in the S° block. Bonstrom et al. (2009) divided fractures into two sets, those with apertures greater than 1.4 mm and those between 0.6 to 1.4 mm. The spacing of the larger aperture fractures (> 1.4 mm) ranged from 0.26 to 1.25 m with the spacing of the smaller set (0.6 to 1.4 mm) ranging from 0.18 to 0.19 m.

If the larger aperture fractures were the main flow conduits within the S^o block, then the smallest test interval would have had much less chance of intersecting one of these larger fractures based on the limited number of 'scale tests' conducted in this study.

As can be seen in Figures 4.38 through 4.40, K_g increases with scale. As only a limited number of tests and interval lengths were used, no apparent upper bound on K_g was attained.

4.3.8 Anisotropy

The effects of anisotropy were evaluated indirectly from tests conducted on the A vertical borehole. The A vertical borehole was situated near five CMT gas ports at radial distances ranging from 2.7 to 4.7 m (Figure 3.5) all at various angles to the A vertical borehole. Early on in the study it was hypothesized, that for such a seemingly heterogeneous material, the pressure response at the various CMT's would have been erratic with little to no discernible pattern. However, the greatest pressure response was identified at CMT's closest to the test location and at CMT channels near the same depth as the test interval (i.e. 140909-A-Vert-3; Figure 4.41). An exception to this was CMT 127 (radial distance of 2.7 m), which showed no pressure response during any of the tests (data not shown). Although, the S^o block exhibited a discernible pattern for CMT channels that were at depths equal to the test interval, CMT channels that were at shallower or deeper depths than the test interval were more inconsistent. For example, during the same test (140909-A-Vert-3; Figure 4.41) at a monitoring depth of 6.4 m the greatest response did not occur at the CMT closest to the test interval (radial distance of 3.7 m) but occurred at a radial distance of 4.2 m. This type of pattern was observed in several tests and may illustrate that the block is anisotropic with respect to conductivity.

Although, the block exhibited anisotropy in regards to K_g for some tests, the pressure response in most instances was approximated with reasonable accuracy when modeled as an

EPM. Therefore, simple EPM numerical and analytical models appeared to provide a valid approach to determine fluid movement in such a heterogeneous media.

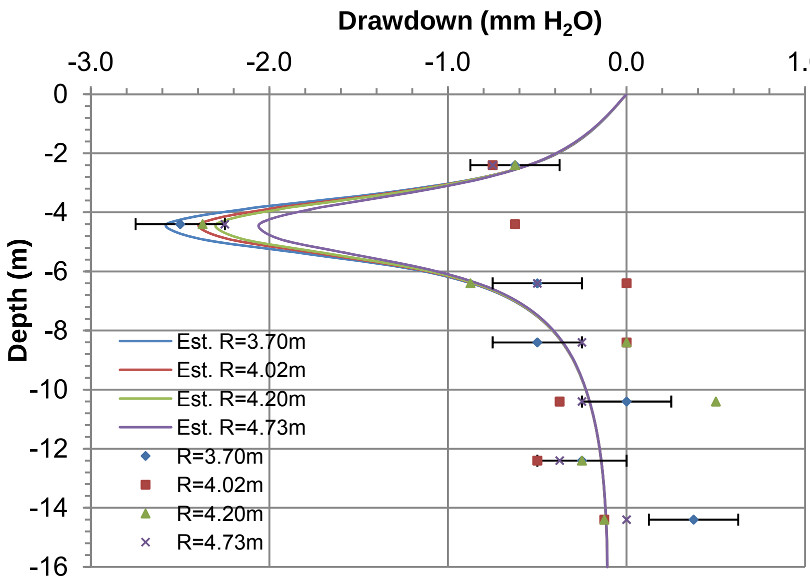

Figure 4.41 Measured and simulated drawdown versus depth for the A series test 140909-A-Vert-3 (center of test interval = 4.49 mbss, $K_{gx} = 4.5 \times 10^{-4}$ m s^{-1}, $A_{gr} = 0.03$). Data markers represent the field measured pressure response in mm H_2O at the monitoring locations. Solid lines represent the best-fit between the simulated and measured data. Error bars represent the resolution (± 0.25 mm) of the U-tube measurements at the CMT monitoring locations. For clarity, the error bars are shown for the nearest CMT monitoring location only.

4.4 Equivalent Liquid Conductivity

To properly estimate K_l from the pumping test data various combinations of gases and liquids were considered (methodology discussed in Section 3.6.6) and are summarized in Table 3.1. The following section discusses the results of the conversion from K_g to K_l and the implications that the choice of fluid properties and temperature had on the calculation of K_l.

4.4.1 Resulting Liquid Conductivity

The results of the conversion for the 140909-A-Vert-5 test series are shown in Figure 4.42. As can be seen in Figure 4.42 the choice of gas had a negligible effect on the computation of k_g and there was only a slight increase in k_g with temperature, irrespective of the type of gas. The moderate increase of k_g, with temperature, in comparison to K_l, was offset by a decrease in gas density with increasing viscosity as the temperature was increased. Figure 4.43 illustrates how both the gas density and viscosity change with temperature. Overall the change in the gas properties with increasing temperature was quite small. The AGC gas had both the smallest density and viscosity of all of the gases considered although all three gases exhibited similar changes with temperature for both properties.

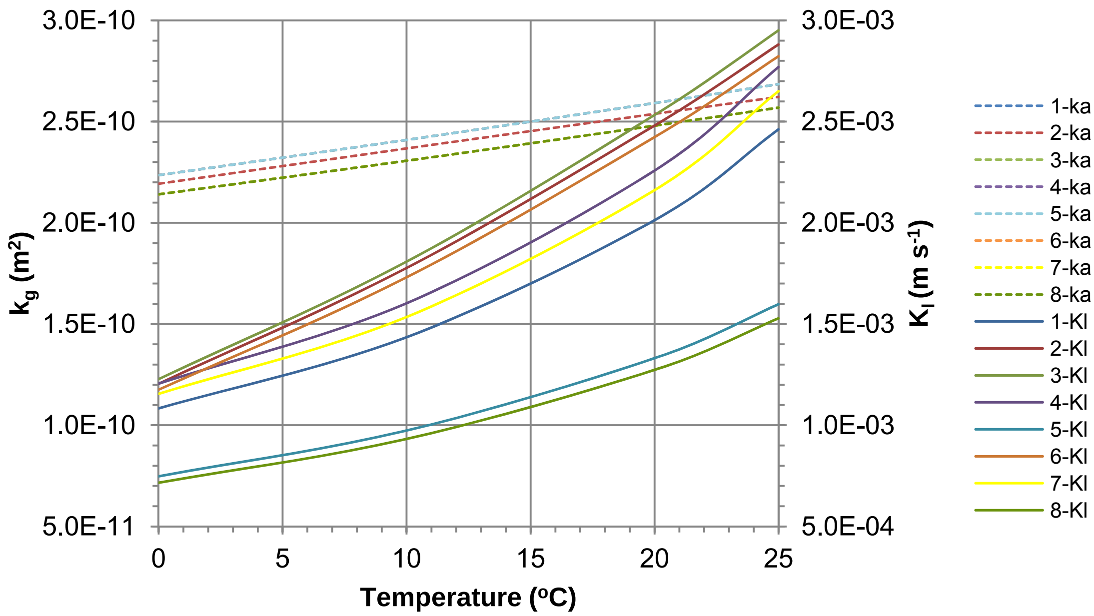

Figure 4.42 k and K_l for A series test 140909-A-Vert-5. Legend titles correspond to the combination ID indicated in Table 3.1. Dashed lines represent k_g after conversion from K_{gx} and the solid lines are the resulting K_l values using the Bloomfield and Williams (1995) formulation to relate k_g and k_l.

In contrast to the choice of gas, the choice of liquid had a more significant effect on the resulting K_l value (Figure 4.44). The liquid density was nearly constant over the range of temperatures considered while the dynamic viscosity (Figure 4.43) varies substantially in comparison. Although the density for each of the liquids was nearly constant over the range of temperatures, the density of the pH -2 acid was much greater that any of the other liquids considered. Based on the relationship between k_l and K_l, this should result in a greater K_l;

however, the viscosity of the pH -2 acid was also much larger than either of the other liquids considered and changes by a greater degree than the density. This resulted in combinations 5 and 8 having the lowest values of K_l.

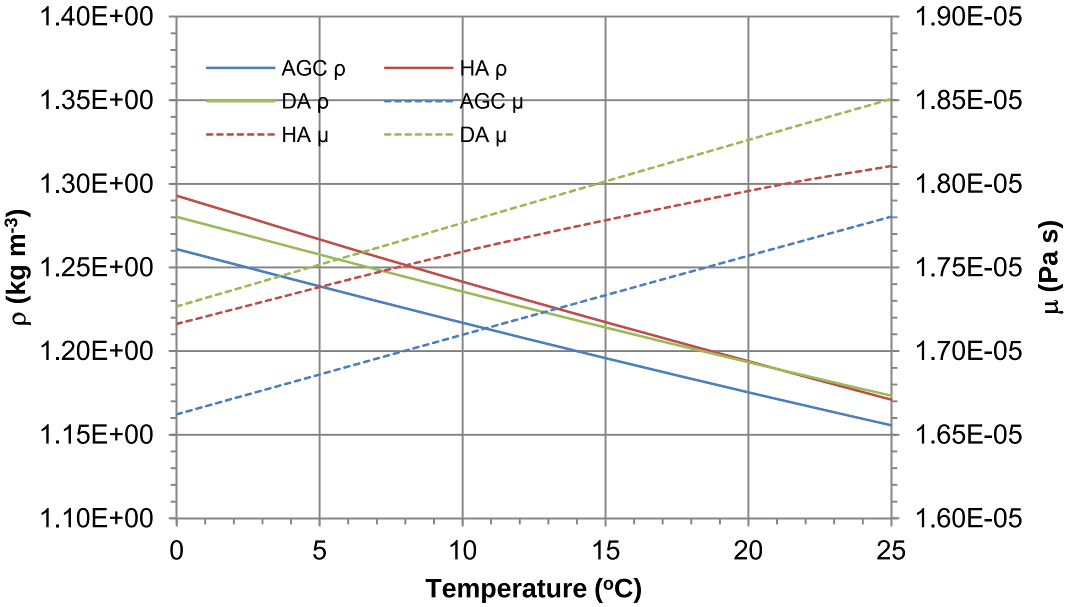

Figure 4.43 Relationship of gas density and dynamic viscosity with changing temperature. Solid lines represent density and dashed lines the viscosity.

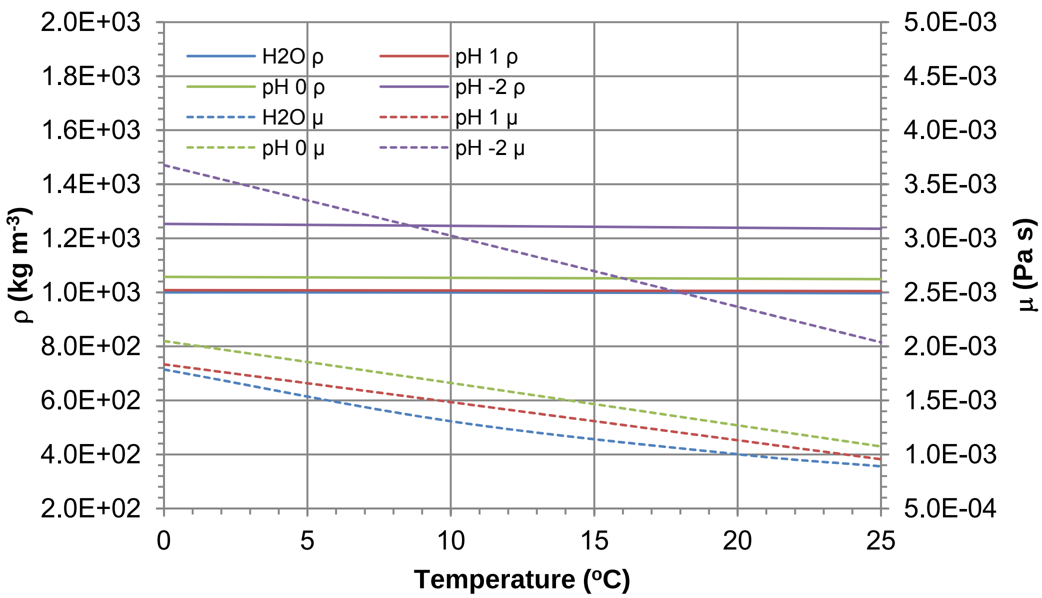

Figure 4.44 Relationship of liquid density and dynamic viscosity with changing temperature. Solid lines represent density and dashed lines the viscosity.

Figure 4.45 is a plot of the ratio of the fluid properties required to convert from K_g to K_l. This figure can be used to determine a multiplication factor to compute K_l value directly from K_g for various gas and liquid compositions for the range of temperatures considered if equivalence between k_g and k_l can be assumed valid. Conversely, Figure 4.45 can be used to determine K_g for an assumed value of K_l. This figure also illustrated how the choice of fluids would affect the resulting K_l value for liquids ranging between pure water and H_2SO_4 of pH -2 and gases consisting of dry or humid atmospheric air and the average gas composition of the block. The largest K_l value result when the liquid within the block was water and decreased with increasing strength of H_2SO_4. The composition of the gases considered in this study had very little effect on K_l regardless of the temperature.

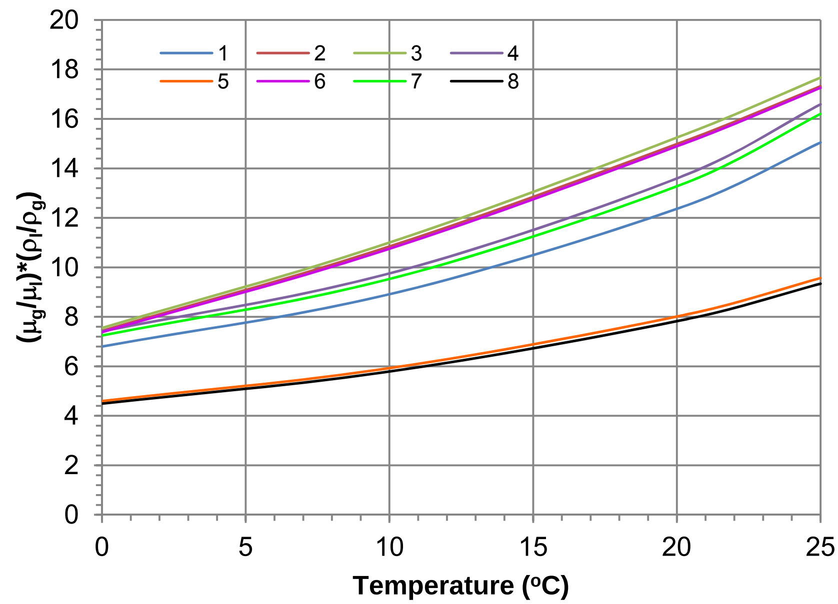

Figure 4.45 Ratio of gas and liquid densities and viscosities required for conversion from K_g to K_l. Legend corresponds to the combination IDs of Table 3.1. The figure is based on the assumption that k_g and k_l are equivalent.

The resulting cross-hole horizontal liquid conductivity values (K_{lx}), based on the range and geometric mean of the K_g values presented earlier are summarized in Table 4.7. K_{lx} values are shown for combinations 3 and 8 as these combinations enveloped the range of K_{lx} values that could potentially exist within the S^o block based on the fluids considered. In addition, the range of k values is also summarized in Table 4.7. These values were calculated based on the assumption that the relationship between k_g and k_l presented by Bloomfield and Williams (1995) is applicable. Although, this relationship was used in nearly all of the calculations conducted in this study to determine K_{lx}, this relationship could not be confirmed because no tests using water were conducted. However, a comparison of the k values with and without the use of this relationship showed only a slight difference (Figure 4.46; $R^2 = 1$). In general, omission of the proposed relationship and assumption of equivalent k determined by either gas or liquid resulted in a maximum difference in K_{lx} of approximately 20 %.

Table 4.7 Summary of k and K_{lx} for the previously calculated range and geometric means. Only the values for combinations 3 and 8 are presented as these gas and liquid compositions resulted in the minimum and maximum K_{lx} values.

Parameter	**Combination 3**			**Combination 8**		
	Minimum	**Geometric Mean**	**Maximum**	**Minimum**	**Geometric Mean**	**Maximum**
k^1 (m^2)	6.8×10^{-12}	2.7×10^{-10}	1.3×10^{-9}	6.7×10^{-12}	2.6×10^{-10}	1.3×10^{-9}
K_{lx} ($m\ s^{-1}$)	5.1×10^{-5}	2.0×10^{-3}	9.9×10^{-3}	2.7×10^{-5}	1.1×10^{-3}	5.2×10^{-3}

Notes:
- Subscript ^{1} in first row of the table indicates that the k was determined using the relationship of Bloomfield and Williams (1995).

As discussed earlier, the predominant reason attributed to differences between k_g and k_l is due to gas slippage (Klinkenburg, 1941; Rasmussen et al., 1993). However, it has been suggested by various researchers that gas slippage may be negligible in larger and more conductive flow conduits (Massmann, 1989; Rasmussen et al., 1995; Edwards and Jones, 1994). Bloomfield and William (1990) suggest that for k values greater than 1×10^{-12} m^2, k_l may be considered analogous to k_g. The minimum computed k value in this study (6.7×10^{-12} m^2) is above this threshold. Therefore, this may nullify the requirement for a relationship between k_g and k_l allowing for direct computation of K_{lx} from gas tests based simply on a ratio of the fluid properties such as in Figure 4.45.

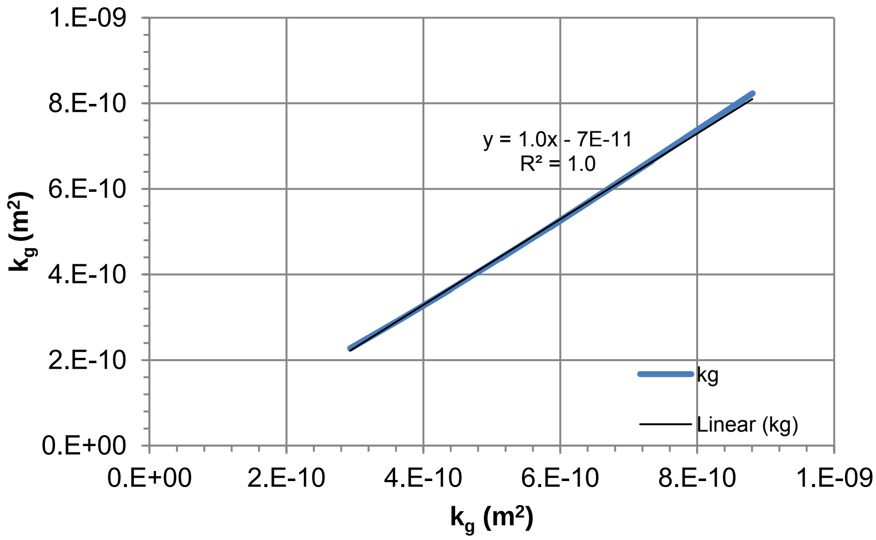

Figure 4.46 Comparison of k values calculated based on the assumption that k_g and k_l are equivalent (x-axis) and using the relationship of Bloomfield and Williams (1995) [y-axis].

4.4.2 Comparison of Resulting Liquid Conductivity Values

For comparative purposes, the K_{lx} values in this study were compared against the theoretical values calculated by Bonstrom (2007). Based on fracture mapping data, Bonstrom (2007) computed a theoretical K for the block using the cubic law of Snow (1969). For a specific matric potential and based on the computed aperture distribution, Bonstrom computed the minimum fracture aperture that would be fluid filled. It was assumed that all fractures with apertures greater than this minimum would be capable of transporting fluid for the corresponding matric potential. Summation of all of the fractures contributing to fluid flow was used to estimate the corresponding K_{unsat} value. K_{unsat} values were computed over the range of measured apertures and the total K_{unsat} (inferred to be analogous to K_{lx}) was taken to be the point when all of the fractures were contributing to flow.

The total K_{unsat} for all contributing fractures was calculated by Bonstrom (2007) to be 2.7×10^{-3} m s^{-1}. Bonstrom (2007) noted that this value was similar to the K_{unsat} computed for the largest aperture increment alone (13.7 mm). For comparison the theoretical value computed by Bontsrom (2007) was referenced to the K_l value of combination 3, as water was the permeating fluid used by Bonstrom (2007). The resulting K_{lx} value in this study (geometric mean of 2.0×10^{-3} m s^{-1}) compared closely to the theoretical value computed by Bonstrom (2007). In addition, the fact that the total K_{unsat} value was near the K_{unsat} value for the 13.7 mm fracture alone, may indicate that the range of effective apertures (2.6 to 6.7 mm) determined in this study were reasonable for the range of K_{lx} values.

Although, the K_{lx} value measured in this study and the theoretical value from Bonstrom (2007) were similar, K_{lx} was generally an order of magnitude greater than the K_b values computed by Bonstrom (2007) from shallow hydraulic packer tests. An even greater difference, up to three orders of magnitude, was observed when K_{lx} was compared to the results of the deeper packer tests. However, Bonstrom (2007) indicated that an, unexplainable, disproportional relationship between flow rate and pressure occurred during the packer tests that may have been caused by the onset of hydraulic fracturing when the overburden stress was exceeded by the injection pressure during the shallow packer tests.

Birkham et al. (2011) simulated the outflow response of the Phase 1 block to discrete rainfall events. Their simulations produced a best-fit to the measured outflow with an estimated K of 1×10^{-2} m s^{-1} and specific yield of 4%. Although, the estimated conductivity of Birkham et al. (2011) was nearly an order magnitude greater than that determined in this study, the discrepancy may be the result of the combined effect of specific yield and/or the scale of measurement. To determine a best-fit between the simulated and measured outflow response, Birkham et al. (2011)

adjusted both the specific yield and conductivity. They noted that alteration of both the specific yield and K could produce a similar outflow response time. If the specific yield were increased, a proportional decrease would have to be made to K and vice versa. Modeling the flow response through the block during a rainfall event would occur throughout the entirety of the block and therefore would invoke flow through the most conductive fractures.

4.4.3 Verification of the Assumption of Fracture Flow

Based on the similarity between the theoretical total K_{unsat} and K_{lx} values and that K_{unsat} was assumed to account for fracture flow only, the assumption of fracture flow as the primary means of flow conductance in the S^o block appears valid. A similar conclusion arises from observation of the frequency distribution of K_{gx} (Figure 4.30). A unimodal normal frequency distribution, such as in Figure 4.30, typically indicates that only a single pore space is contributing to flow. Based on the relatively high K_g values determined in this study, it is reasonable to assume that the fracture pore space is the primary flow conduit. However, the frequency distribution of the K_{gs} values portrays a bimodal distribution (Figure 4.31). A bimodal distribution is common of media in which two pore systems contribute to flow at disproportional conductivities (Tidwell and Wilson, 1999; Leven et al., 2004). Depending on the spatial location of the test either one or both pore structures could be contributing to flow. Because of the disproportionally between the rates of the two pore structures, the overall flow rate will vary greatly between locations indicating when only the pores of the lowest conductance are solely contributing to the flow.

One possible explanation for the apparent bimodality of K_{gs} could be the inclusion/exclusion of more conductive fractures in only some of the test intervals. This would seem reasonable due to the fact that the K_g values from the larger screened intervals (deeper packer tests) used to study the effect of scale, approached the geometric mean of the K_{gx} values. However, if this was the case, hypothetically a similar response should have been identified in the cross-hole tests. No formal investigation was conducted to determine the apparent bimodality of K_{gs}.

4.5 S^o Block Internal Acid Strength

The block's internal acid strength was deduced from measurements of the in situ RH using a variety of measurement techniques. The following sections describe the results obtained from the RH measurements.

4.5.1 Packer RH Measurements

The packers were envisioned to represent the most accurate measurements of the RH as the data was measured within the block at discrete intervals and did not require temperature corrections. However, the RH data obtained via the packers was assumed erroneous because the RH data remained at 100 % throughout the entire measurement period in all three boreholes. Upon removal of the packers from the block a large volume of water was observed in the lower reducer of the open interval. It is hypothesized that water entering the block was transported through the fractures to the open interval with little residence time. The packer section below this reducer sealed this water in these intervals, allowing for limited interaction of water with the S^o block, thus resulting in the fresh water (100% RH).

4.5.2 Manual Measurements

Analysis of the data from RH measurements obtained via the manual syringe method produced ambiguous results. Inspection of these data illustrated a direct correlation to surface measurement temperature. Although the data was corrected for temperature differences between the relatively constant block temperature and the fluctuating surface temperature, the data displayed a direct relationship with surface temperature. Theoretically, the temperature corrected RH should be consistent due to the relatively constant block temperature and should only change due to temperature fluctuations within the block, precipitation, and large ambient barometric pressure or RH changes. However, no correlation between these variables and the RH was observed.

To discern if the methodology using the ibuttons was in error, simple experiments were conducted under known and controlled RH and temperature conditions. An ibutton hygrochron was placed in a refrigerator and allowed to equilibrate. Once equilibrated, a 60 ml syringe was used to remove air from directly above the refrigerated ibutton via tygon tubing following a procedure identical to that used during the field measurements. This experiment was conducted with the 'surface' syringe at various temperatures. When there was a minimal temperature difference between the ibutton in the surface syringe and the refrigerated ibutton, the results could be closely reproduced using the standard temperature corrections. However, as the temperature of the 'surface' syringe increased the results could not be reproduced. Several alternatives were investigated in an attempt to determine the cause of the discrepancy including development of a correction factor for irregularities in the ibutton measurements at RH and temperature extremes (procedure described in Section 3.7.4). Although the correction procedure illustrated error in the ibuttons RH measurement abilities at both extreme temperatures and RH, correction for this did not rectify the correlation between surface temperature and in situ RH. It was hypothesized that the error was the result of a combination of a rapid temperature increase caused through friction in the syringe as the CMTs were being purged on warm days and the method in which the ibutton measures RH and compensates for changing temperature. However, no verification of this hypothesis was investigated.

4.5.3 Continuous Pump RH Measurements

The use of aquarium pumps appeared to produce the most reliable RH data. Although the data still required temperature correction, the combination of both insulation (2009 only) and coolers to house the pumps resulted in much more gradual temperature fluctuations. For the

2008 data and the first week of the 2009 data, only measurements made during midday were considered to be accurate as this was the only time of the day in which the solar panels provided sufficient power to operate the pumps. In 2009 after the first week of measurements, the aquarium pump setup was modified (Section 3.7.4) so that the pumps would have sufficient power to operate continuously. The only time the pumps were stopped during the measurement period was intermittently between the 21st and 23rd of September when the CMTs were being used to monitor the pressure during the cross-hole pumping tests (BV, BA, and CA).

4.5.4 Block RH

Prior to estimating the RH within the block, each ibutton RH measurement was adjusted by the correction factor discussed earlier. To estimate the RH within the block it was assumed that the partial water vapor pressure (P_v) would remain constant between the surface of the block and at the depth from which the RH measurement was taken P_v was computed from the surface RH measurements using the relationship:

$$P_v = \frac{(RH)P_{vs}}{100} \qquad [4.5]$$

where P_{vs} is the saturated water vapor pressure (mm Hg) at the surface measurement temperature. P_{vs} for the surface and block temperatures was determined using the data of Goff and Gratch (1946). Based on the resulting P_v from the surface measurements and an estimate of the block temperature, Equation 4.5 was used to determine the corresponding block RH. Block temperature was estimated based on measurements collected from thermistors installed at various depths and locations within the block (Birkham et al., 2010a). Because no data were available for the time period over which the tests were completed, the seasonal mean temperature in the vicinity and depth of each test was used.

The resulting block RH measurements for CMT 143 and daily total precipitation are shown in Figure 4.47. The daily total precipitation was recorded at a weather station located less than 1 km from the Phase 1 S^o block (A. Heidman, personal communications). As evident in Figure 4.47, the data displayed a diurnal pattern. Goss and Madliger (2007) observed a similar pattern in their study of vapor transport in a dry Tanzanian soil and attributed this to changes in temperature and potential water vapor transport within the soil profile. The diurnal RH pattern could not be attributed to changes in block temperature because the block temperature remains constant seasonally. It was possible that changes in the outside air temperature could result in variable ambient moisture creating a water vapor gradient and causing air to be pumped in and out of the block. However, the investigation of such a phenomenon was deemed beyond the scope of the current study. A more likely cause for the diurnal pattern in the block RH was due to the method (ideal gas law) used to relate the block RH and surface measurements. The methodology used assumed that the moist air within the block would behave as an ideal gas irrespective of the temperature and RH and that the RH would change instantaneously with temperature. It was also assumed that no moisture would be gained or lost as air was pumped from the measurement depth to the surface of the block. The greatest spikes in the block RH occurred when the difference between the estimated block temperature and surface temperature was largest.

Despite the diurnal pattern in the RH data, fluctuations in the RH data attributed to precipitation can be observed. Prior to and during the study period, there were several precipitation events. The largest was a precipitation event that occurred prior to data collection between the 21st to 24th (inclusive) of August 2009; over the course of four days the total daily precipitation was approximately 29 mm. Because no RH data was collected during this precipitation event, direct changes in the RH were not observed. It appeared, however, that the RH may have risen dramatically during this period and slowly returned to steady values. During the data collection period, there were three precipitation events of similar magnitude (~ 3 mm): September 6th, 15th, and 27th. Immediately following each precipitation event there was a slight rise in the RH value at each measurement depth followed by short steady period after which RH once again declined. It appears that over the study period the magnitude of the RH at all depths was in general decreasing despite the variations caused by intermittent precipitation.

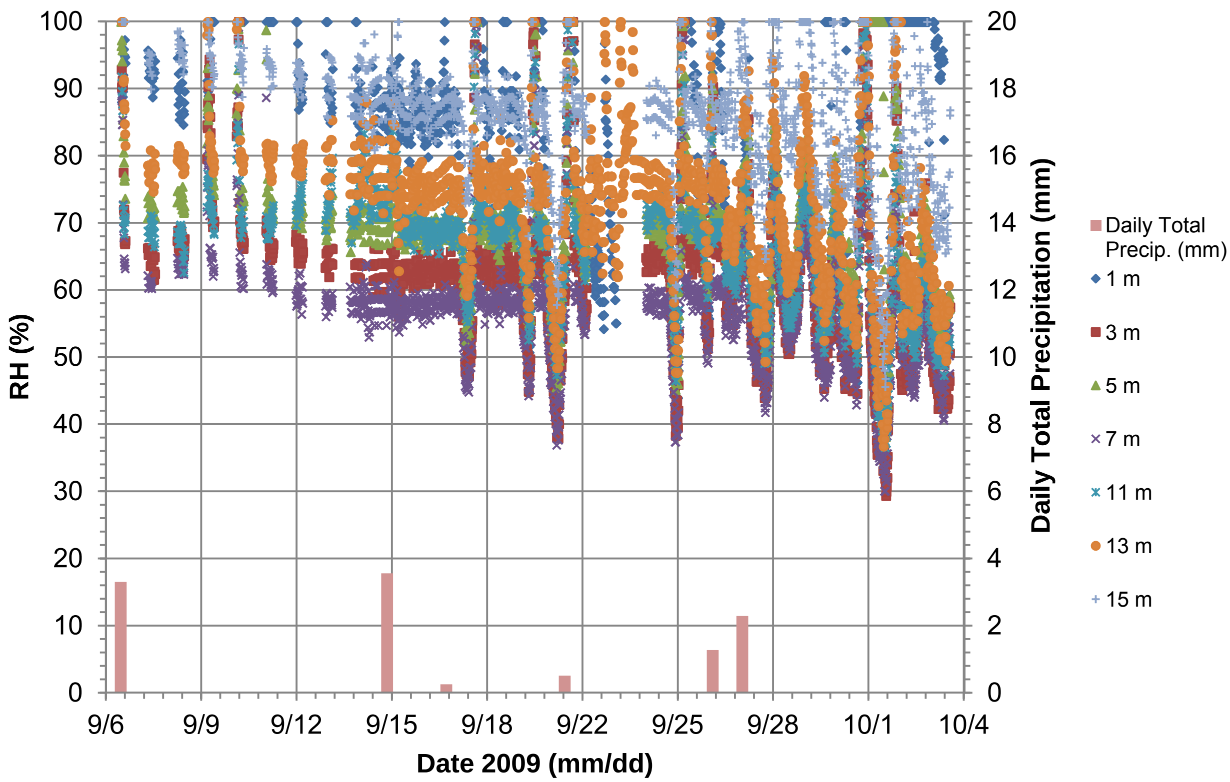

Figure 4.47 Block RH data and daily total precipitation measured in fall of 2009. Daily total precipitation is shown on the secondary vertical axis.

From Figure 4.47, the highest RH occurred at the shallowest and deepest measurement depths and displayed the greatest increase in RH following precipitation. Based on the measurement depths observed in this study the RH decreased until approximately 3 mbss after which it increased slightly between the 3 and 5 mbss measurement depths. The RH began to decrease again beyond 5 mbss reaching a minimum at approximately 7 mbss after which it increased with depth. The greatest variation in the data occurred at the 3 and 7 mbss depths, which exhibited the lowest RH values measured. The least variation was observed for the deepest measurement depth (15 mbss). It is believed that this was due to the continual mixing of fresh and acidic waters near the bottom of the block and the consistency of the temperatures throughout the year. Similar trends were observed in the 2008 data (data not presented). It should be noted that many of the highest RH values shown on Figure 4.47 were assumed values only. After conversion from surface RH to block RH, the data collected at these times was computed to be greater than 100 % RH. Because this is not physically possible any RH value calculated to be greater than 100 % was assigned a value of 99.9 % and was used in the calculation of pH.

Comparison of the RH data collected from the packer tests and the RH pumps illustrates large differences (data not presented here). As discussed previously, the RH within the test interval quickly increased to 100 % and remained at 100 % for the duration of all of the tests conducted. Although an in depth investigation into this matter was not conducted, it was hypothesized that the pumping test could have drawn air from locations of greater moisture content in the block.

Another possible mechanism could have been the influx of ambient air into the block caused by pumping. Because the first packer test at each location was near the surface of the block and the flow rates for each test were high, ambient air could have been drawn into the block. For example, during the B vertical tests the mean RH and temperature of the ambient air was measured to be 60 % and 20 ^{o}C, respectively. It this air was drawn into the block, for which the mean temperature was approximately 12 ^{o}C, the change in temperature would have resulted in the RH being raised to 99 %. As the test progressed deeper into the block the outside air drawn into the block during the shallowest pumping test may continue to be drawn to lower depths within the block and a similar elevated RH would be observed. At the duration of a single pumping test, approximately an hour in length, between 30 and 70 m^3 of air would have been pumped from the block. This would be approximately 0.5 % of the entire fractured pore space of the block and therefore, it would be reasonable to assume that ambient air was being drawn into the block during either a single pumping test or over multiple tests in the same borehole. In contrast, the aquarium pumps move only a small volume of air in the block. For example, it would take longer than one week of continuous pumping to remove the minimum estimated volume of air pumped during a one-hour pumping test (30 m^3).

4.5.5 Conversion from Block RH to pH

Prior to determining the resulting pH values for the block RH, the RH data was averaged to remove the diurnal pattern believed to be an artifact of the conversion methodology. Although it was possible that the block RH may in fact change diurnally, it was assumed that the pH would be much more consistent. Because the diurnal RH data exhibited both a maximum and minimum peak within a single day, it was assumed that taking the mean of a full day of data would result in the most representative values of pH. The mean RH data was presented in Figure 4.48. As was the case in Figure 4.47, a slight increase in RH following precipitation was observed in Figure 4.48.

Based on the resulting mean RH data (Figure 4.48), the weight percent H_2SO_4 was interpolated from the data of Wilson (1921) for the corresponding block temperature. The equivalent molality was determined based on the weight percent and converted to pH using the relationship of Nordstrom et al. (2000). The resulting pH values based on the fall 2009 RH measurements for CMT 143 are presented in Figure 4.49. Similar to the block RH, the resulting pH increases slightly following precipitation but in general appeared to decline over the study period.

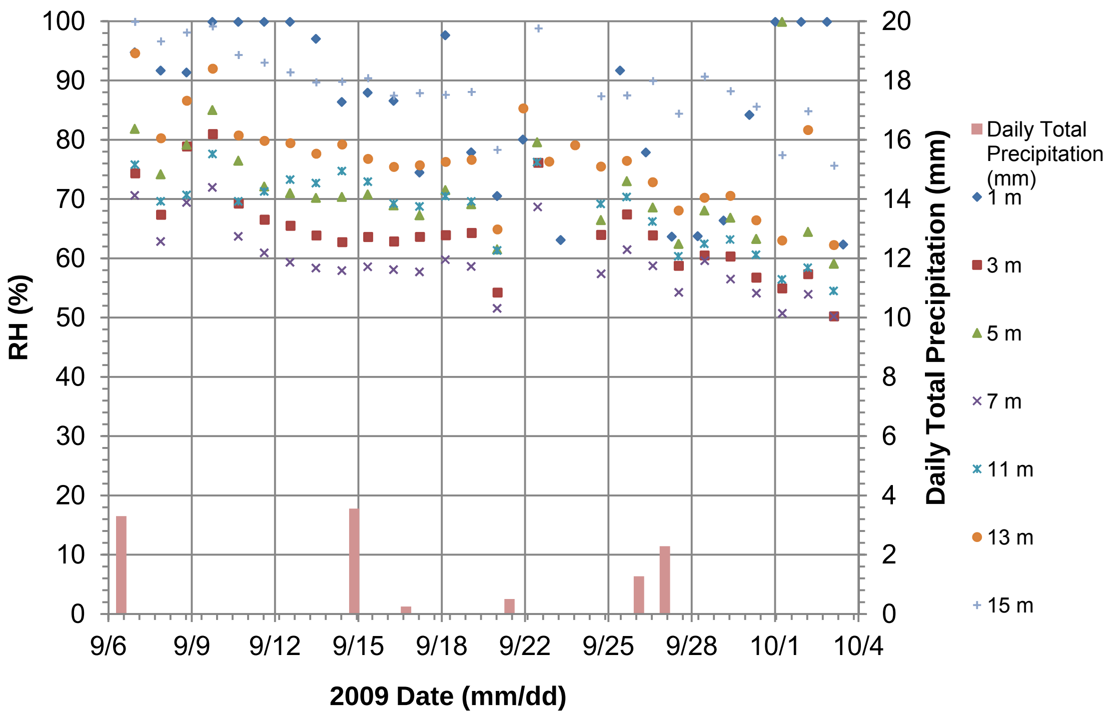

Figure 4.48 Daily mean block RH data and daily total precipitation. Daily total precipitation is plotted as pink columns on the secondary vertical axis.

Based on the assumption that depression of the RH within the block was caused by increases in solute concentration, the greatest pH in the block would be at the depths at which the RH was the lowest. Therefore, the minimum (most negative) pH would be at the 3 and 7 mbss measurement depths and the maximum (least negative) pH at the shallowest and deepest measurement depths. The range and arithmetic mean of the pH data for each measurement depth is illustrated below in Figure 4.50.

The mean and minimum data from Figure 4.50 agree well with the visual observation of Figure 4.49 that the minimum pH occurred at depths of approximately 3 and 7 mbss. The 2008 data indicated a similar trend with the minimum pH occurring at approximately 6.5 mbss. The minimum (-3.2) and mean (-1.7) pH values measured in this study were similar to those measured at CMT 143 on the Phase 1 block by Birkham et al. (2010a) in 2007 (minimum: -3.8; mean: -2.1); however, the location of the minimum pH varied between studies. Although the magnitude and location of the pH values varied, a similar trend was observed between the data of Birkham et al. (2010b) and the current measurements. Discrepancies may be due to the fact that the values reported in this study were the mean daily values and meteorological conditions may have been significantly different between 2007 and 2009.

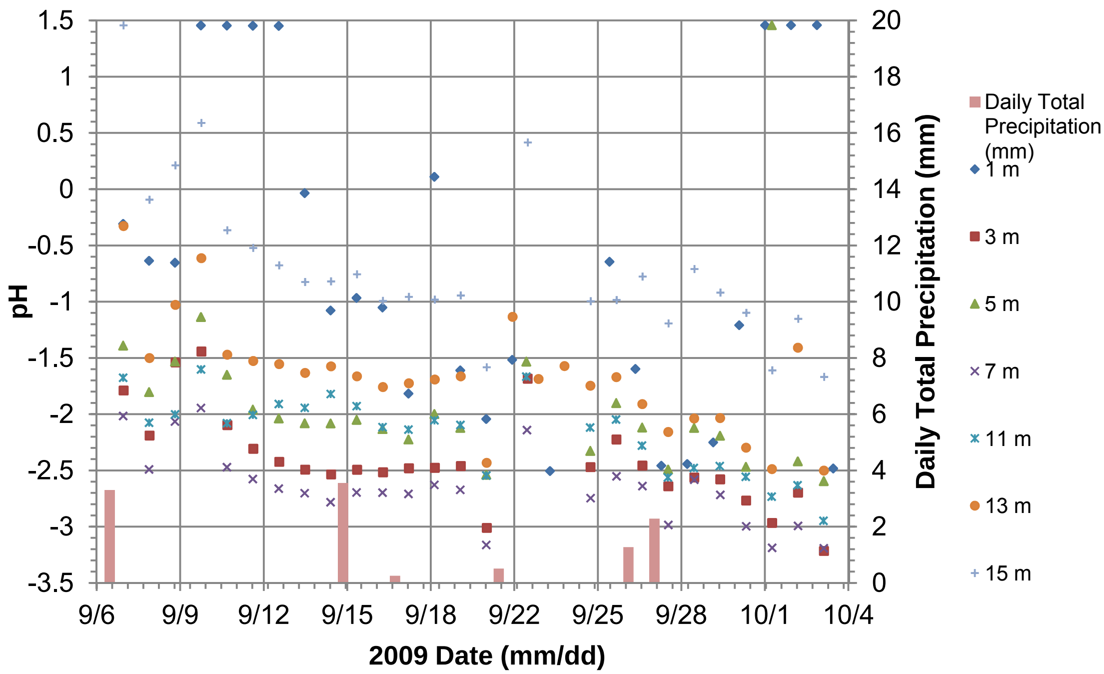

Figure 4.49 Mean pH values and daily total precipitation measured in 2009. Measurements were taken at CMT 143 on the Phase 1 S^o block. The pH data was computed based on the daily mean RH data over the study period.

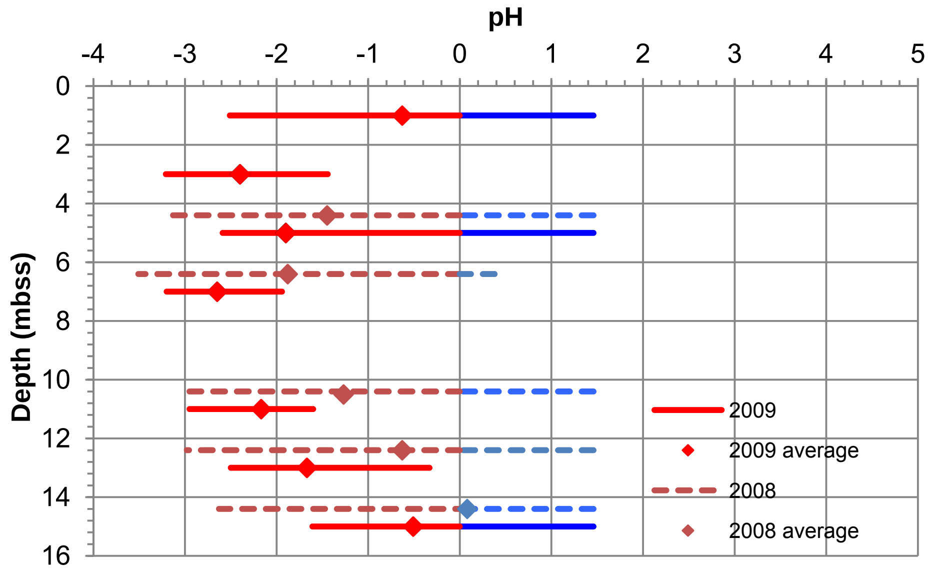

Figure 4.50 Range and mean of pH values measured in 2008 and 2009 on the Phase 1 block. Measurements were taken at CMT 143 in 2009 and CMT's 129 and 131 in 2008. The pH data was computed based on the daily mean RH data over the study period. The solid bar represents the range of values observed and the diamond symbols represent the mean of the pH data at the same depth. Blue values represent data that had a pH greater than 0 and red data that is less than 0.

CHAPTER 5.
CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The main objective of this study, as outlined in Chapter 1, was to characterize the hydraulic characteristics of blocks indirectly by determination of the K_g of the S^o block. The secondary objective of the study was to evaluate the variation in stored acidity within the block to verify the cyclic nature of the internal acid strength of the block. The objectives of this research program were achieved through field testing and numerical simulations.

5.2 Conclusions

The mean horizontal fracture spacing, determined from borehole videos, was 0.05 m (open and closed fractures) and 0.16 m (open). Many of the horizontal fractures appeared to be coincident with lift interfaces. The mean number of vertical fractures was classified based on the orientation of the borehole. The mean vertical fracture length in a vertical borehole was 0.15 m. For the angled boreholes, the mean vertical fracture length for parallel and perpendicular fractures was 0.20 and 0.14 m, respectively. Although vertical fractures were identified in both vertical and angled boreholes, the interconnectedness of vertical fractures was more prominent in the angled boreholes. In some cases, fractures were identified only by dark staining along the borehole wall whereas some fractures were evident due to the presence of small to large voids along the fracture. Water droplets were observed along the borehole walls in both the vertical and angled boreholes but were more evident in the angled boreholes. The pH of these water droplets were measured to be less than or equal to 4.5 using pH strips.

Analysis of the gas pumping data using both analytical solutions and numerical modeling produced similar K_g values. The geometric means of the resulting K_{gs} values, determined from both the analytical solution and numerical modeling (A and B series tests only), were 2.0×10^{-5}

and 1.7 x 10^{-5} m s^{-1}, respectively. Similarly, the analytical solution and numerical modeling of the K_{gx} data produced comparable results. However, K_g values determined from the analytical solution were slightly greater than the corresponding numerical modeling result for the single-hole tests whereas the numerical model produced greater K_g values for the cross-hole tests. The geometric mean of the K_{gx} values was 2.3 x 10^{-4} m s^{-1}.

The anisotropy of K_g in the S^o block was simulated using numerical models. Anisotropy ratios of K_g ranged from 1:100 to 1:2 with a geometric mean of approximately 7:100. The corresponding geometric mean of the K_{gy} values was 1.7 x 10^{-5} m s^{-1}. Although the K_{gy} values of the block were an order of magnitude smaller than K_{gx} it should be noted that the Phase 1 block at the SCL site was highly conductive in both the horizontal and vertical directions. In keeping with the K_{gx} and K_{gs} values, the range of K_{gy} was relatively small and the ranges of K_{gx}, K_{gs}, and K_{gy} were all less than half an order of magnitude.

In theory, the K_{gs} and K_{gx} values should be nearly equivalent, however, in all cases, the K_{gx} values were calculated to be an order of magnitude greater than K_{gs}. In addition, a large discrepancy was observed between the measured and simulated pressure response in the test interval based on the cross-hole numerical modeling results. Two scenarios were analyzed to determine the cause of the discrepancy: skin effects and turbulent flow. From these analyses, it was shown that skin effects could produce the additional headloss near the borehole. However, the headloss across the skin layer remained constant with increasing flow rate in contrast to the observed increase in the ratio of simulated to measured pressure response in the test interval. Evaluation of the Re number in the vicinity of the borehole illustrated that the majority of the gas flow should be laminar. However, at the highest applied flow rates, the Re values approached Re_c (1000 to 1200). Because the fractures were assumed to be smooth walled and of uniform properties, it is possible that fracture irregularities may have caused the flow to transition from laminar to turbulent, resulting in additional headloss as flow converged near the borehole. A correction procedure was applied to the single-hole data to compensate for turbulent flow. This correction resulted in a reduction in the difference between the K_{gx} and K_{gs} values for most tests, but did not produce identical results. It was postulated that the cross-hole gas conductivity values may provide the most representative estimate of the conductivity of the block.

Based on a limited number of gas pumping tests at variable test scales, the data indicates that K_g increases with increasing test scale. It was envisioned that this scale effect was the result of the increased probability of intersecting more highly conductivity fractures with increased test scale. No attempt was made to conduct tests with a small enough test interval in order to characterize the matrix conductivity in the field. From the resulting data set it was determined that a test length of approximately 1 to 3 cm would have had to have been used in order to determine conductivity values representative of the matrix conductivity. No upper bound on K with test scale was observed in this study.

A range of combinations of gases and liquids were assessed in the determination of the K_l from the results of the gas pumping test data including: pure water to pH -2 H_2SO_4 and atmospheric air to the average gas concentration of the block. It was identified that the choice of gas had little effect on K_{lx}. In comparison, the type of liquid greatly affected the resulting K_{lx} value. The maximum K_{lx} value was obtained when the liquid within the block was assumed to be pure water and decreased with increasing acid strength due to changes in the viscosity and density of the liquid. The geometric mean of the resulting K_{lx} values using pure water and H_2SO_4 with a pH -2 was 2.0×10^{-3} and 1.1×10^{-3} m s^{-1}, respectively.

The resulting K_{lx} (assuming pure water) value determined in this study was generally an order of magnitude greater than that calculated from hydraulic packer tests conducted on the S^o block by Bonstrom (2007). However, the K_{lx} value determined in this study was comparable to the theoretical K (2.7×10^{-3} m s^{-1}) of Bonstrom (2007) computed using the cubic law equation. The K_{lx} values determined in this study were also comparable to the data of Birkham et al. (2011) who determined the K (on the order of 1×10^{-2} m s^{-1}) from numerical modeling of the outflow response of the S^o block to discrete precipitation events. Discrepancies in K between this study and that of Birkham et al. (2011) may be attributable to the combined use of the specific yield and K to simulate the flow response or an increase in the measurement scale in the latter study.

The most reliable measurement technique of RH within the block appeared to be those collected by continuously pumping air from the block using previously installed CMTs. The RH data collected using the pumping method verified the assumption that the concentration of stored acid within the block may vary both spatially and temporally. Temporal changes in the block RH were observed following discrete precipitation events. This was evident despite diurnal fluctuations in the RH data. The diurnal pattern of the block was believed to be an artifact of the measurement technique with the largest peaks occurring when the temperature difference between the measurement device and the block was the greatest and during periods of elevated RH within the block.

For the 2008 and 2009 data the RH was found to be a minimum at approximately 3 and 7 mbss. Between these measurements the RH increased slightly. Below a depth of 7 m, the RH increased with depth with the maximum RH occurring at the greatest measurement depth within the block. The maximum, mean, and minimum pH within the block was determined from the daily mean of the RH data. Based on the assumed block temperatures the maximum calculated pH was approximately 1.5 and was typically encountered at greater depths (> 11 mbss) within the block and in general at all depths following precipitation. The daily mean pH for all measurement depths was -1.7 and the minimum pH was observed to be -3.2. The RH measurements and corresponding pH values determined in this study were comparable to the minimum (-3.8) and mean values (-2.1) measured by Birkham et al. (2010b).

5.3 Recommendations for Further Work

Based on the results of this study, some recommendations for future work were formulated. These include:

1) Conduct both gas and hydraulic packer field tests on the Phase 1 S^o block (a variably saturated and hydrophobic medium) to confirm the use of gas tests as a method to determine the corresponding K_l. These tests should be completed at the same locations and depths in the block using a similar test methodology and consistent field conditions (i.e. equivalent pressures and fluid saturation).

2) Repeat the RH pump measurement methodology at various locations within the Phase 1 block followed by the excavation of the S^o material in the vicinity of the test location so that direct measurements of the pH of the pore water could be made. This test could help verify the accuracy of the use of RH measurements to evaluate the magnitude of stored acidity within the block and potentially in other geological media.

3) Install RH measurement devices directly in the S^o during block construction (during pouring). This would eliminate uncharacteristic temperature fluctuations in the data and would allow for direct and more representative measurement of RH conditions within the block resulting in a more precise understanding of the stored acidity in the Phase 1 block.

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APPENDIX A

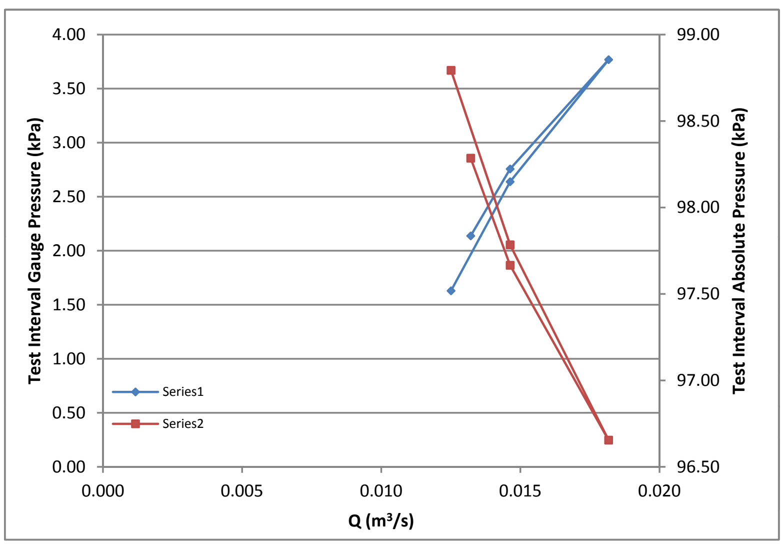
SUMMARY OF PUMPING TEST INFORMATION, PRESSURE-FLOW RATE PLOTS, AND LECAIN (1998) TURBULENCE IDENTIFICATION PLOTS AND CORRECTION FACTORS

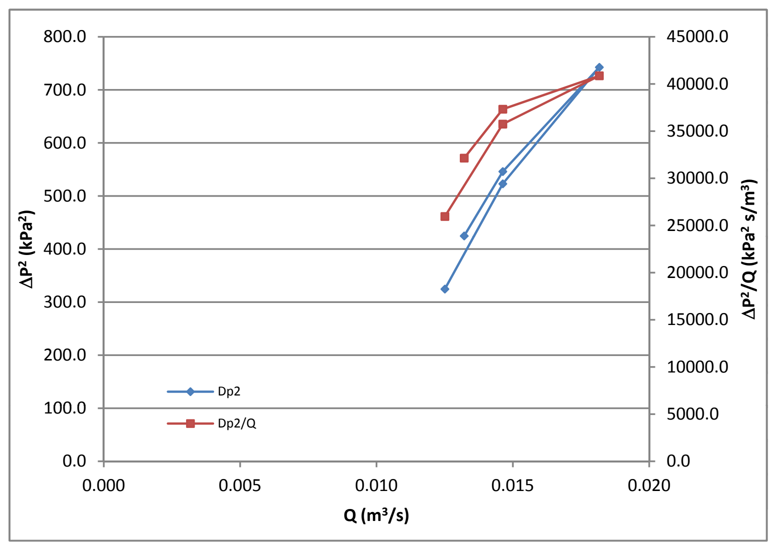
Packer Test:	**140909-A-VERT-1**
Client:	Syncrude Canada Ltd.

Test Date	14-Sep-09
Beginning Time	11:35:30
Ending Time	14:15:15
Test Interval Length (m)	1.38
Center of Test Interval (m)	1.73
Test Interval Temperature	13.5
Ambient Barometric Pressure (kPa	100.4

Measurement	**Depth** (m)
Top of Upper Packer	0.18
Top of Test Interval	1.04
Bottom of Test Interval	2.42
Bottom of Lower Packer	3.28

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (psi)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\ s/m^3$)
1	11:40:45	12:00:30	1590	0.013	2474.65	0.24	1.63	98.79	324.6	25951.2
2	12:00:30	12:23:15	1860	0.015	2454.67	0.38	2.64	97.78	523.0	35744.3
3	12:23:15	12:37:45	2310	0.018	2432.31	0.55	3.77	96.65	742.6	40867.5
4	13:55:15	14:06:45	1860	0.015	2452.33	0.40	2.76	97.67	546.1	37323.4
5	14:06:45	14:15:15	1680	0.013	2464.59	0.31	2.14	98.29	424.7	32139.4





Packer Test: **140909-A-VERT-1**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)] 1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
CMT 131	*Initial Reading*	*-1.37*	*-1.47*	*-1.05*	*-1.39*	*-0.67*	*-1.01*	*0.00*
	1	1.02	-1.31	-0.79	-1.22	-1.11	-0.96	0.00
	2	2.06	-1.04	-0.37	-0.75	-0.36	-0.60	0.00
	3	1.97	-0.20	-1.00	-0.80	-1.14	-0.76	0.00
	4	2.00	0.50	0.00	-1.00	-1.00	-0.50	0.00
	5	1.50	0.00	-1.00	-1.00	-1.50	-1.00	0.00

		1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
CMT 130	*Initial Reading*	*-1.05*	*-1.51*	*-0.83*	*-1.31*	*-1.25*	*-1.14*	*0.00*
	1	0.50	0.00	-0.80	-0.67	-1.03	-1.08	0.00
	2	1.29	0.10	-0.48	-1.00	-0.77	-0.94	0.00
	3	1.50	0.00	-0.50	-1.50	-0.80	-1.00	0.00
	4	1.75	1.00	0.00	-1.00	-1.00	-1.00	0.00
	5	1.00	0.00	0.00	-1.00	-1.00	-1.00	0.00

		1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
CMT 129	*Initial Reading*	*0.00*	*-1.75*	*0.00*	*0.00*	*-1.61*	*-1.47*	*-1.26*
	1	1.16	-0.30	1.20	1.18	-1.10	-1.41	-1.26
	2	1.80	0.00	-1.33	1.42	-1.13	-0.92	0.00
	3	2.10	0.00	0.00	0.77	-1.20	-0.60	-0.60
	4	1.50	0.00	0.00	0.50	-1.00	-0.50	-0.50
	5	1.25	-0.50	0.00	0.50	-1.00	-0.50	-1.00

		1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
CMT 128	*Initial Reading*	*-1.01*	*-1.41*	*0.00*	*0.00*	*-1.54*	*-0.91*	*-0.80*
	1	1.21	-0.60	0.00	0.80	-1.07	-0.93	-0.70
	2	1.88	0.00	0.48	0.76	-1.20	-0.72	-0.70
	3	1.88	0.00	0.00	0.00	-1.50	-0.80	-0.70
	4	1.50	0.00	0.00	0.50	-1.00	-0.50	-0.75
	5	1.28	-1.00	0.00	0.25	-1.50	-0.50	-0.75

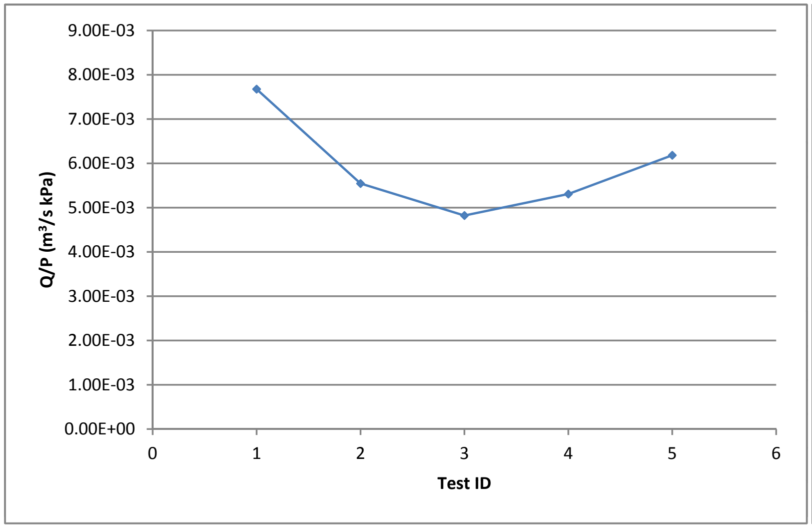
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

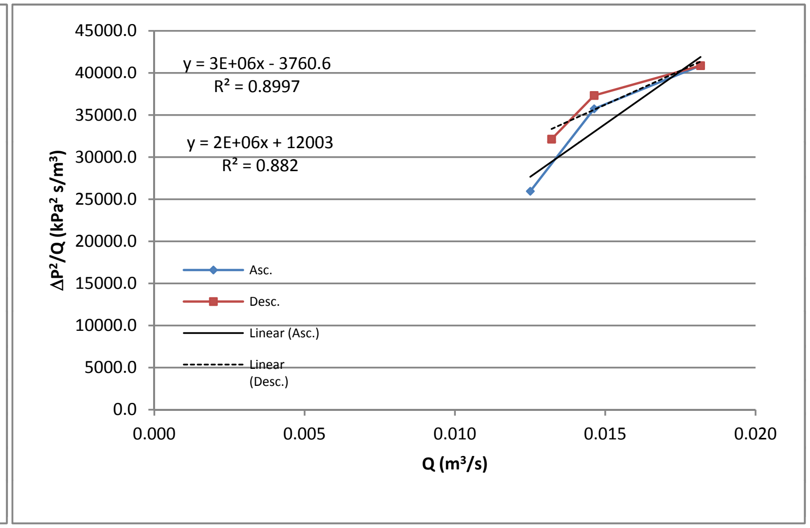
	Measurement ID	Gas Port Number [Measurement Depth (m)] 1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
CMT 131	1	2.39	0.16	0.26	0.17	-0.44	0.05	0.00
	2	3.43	0.43	0.68	0.64	0.31	0.41	0.00
	3	3.34	1.27	0.05	0.59	-0.47	0.25	0.00
	4	3.37	1.97	1.05	0.39	-0.33	0.51	0.00
	5	2.87	1.47	0.05	0.39	-0.83	0.01	0.00

		1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
CMT 130	1	1.55	1.51	0.03	0.64	0.22	0.06	0.00
	2	2.34	1.61	0.35	0.31	0.48	0.20	0.00
	3	2.55	1.51	0.33	-0.19	0.45	0.14	0.00
	4	2.80	2.51	0.83	0.31	0.25	0.14	0.00
	5	2.05	1.51	0.83	0.31	0.25	0.14	0.00

		1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
CMT 129	1	1.16	1.45	1.20	1.18	0.51	0.06	0.00
	2	1.80	1.75	-1.33	1.42	0.48	0.55	1.26
	3	2.10	1.75	0.00	0.77	0.41	0.87	0.66
	4	1.50	1.75	0.00	0.50	0.61	0.97	0.76
	5	1.25	1.25	0.00	0.50	0.61	0.97	0.26

		1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
CMT 128	1	2.22	0.81	0.00	0.80	0.47	-0.02	0.10
	2	2.89	1.41	0.48	0.76	0.34	0.19	0.10
	3	2.89	1.41	0.00	0.00	0.04	0.11	0.10
	4	2.51	1.41	0.00	0.50	0.54	0.41	0.05
	5	2.29	0.41	0.00	0.25	0.04	0.41	0.05





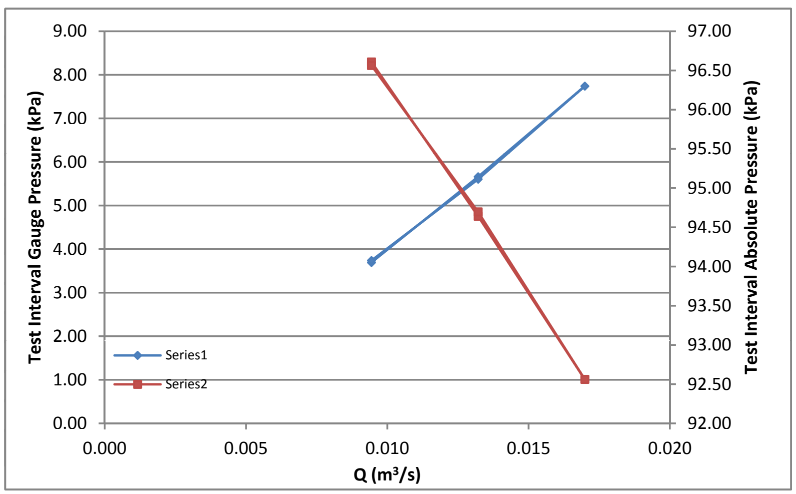
Q/P (m^3/s kPa)
7.68E-03
5.55E-03
4.82E-03
5.31E-03
6.18E-03

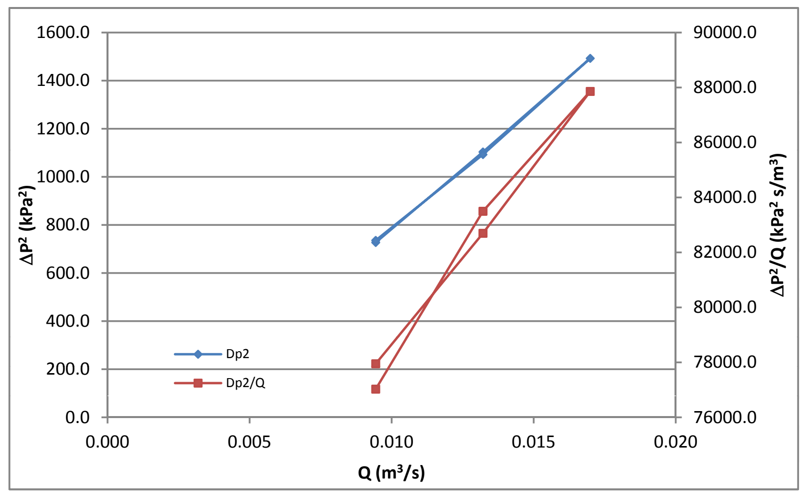
Packer Test:	**140909-A-VERT-2**
Client:	Syncrude Canada Ltd.

Test Date	14-Sep-09
Beginning Time	14:25:00
Ending Time	15:17:30
Test Interval Length (m)	1.38
Center of Test Interval (m)	3.11
Test Interval Temperature	9.0
Ambient Barometric Pressure (kPa)	100.3

Measurement	**Depth** (m)
Top of Upper Packer	1.56
Top of Test Interval	2.42
Bottom of Test Interva	3.80
Bottom of Lower Packe	4.66

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (psi)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2 s/m^3$)
1	14:27:15	14:37:15	1200	0.009	2436.08	0.53	3.69	96.61	727.0	77026.2
2	14:37:15	14:46:00	1680	0.013	2398.12	0.82	5.66	94.64	1103.4	83497.8
3	14:46:00	14:57:30	2160	0.017	2358	1.12	7.74	92.56	1492.7	87858.1
4	14:57:30	15:05:45	1680	0.013	2399.2	0.81	5.60	94.70	1092.8	82695.7
5	15:05:45	15:13:45	1200	0.009	2435.21	0.54	3.74	96.56	735.8	77949.1





Packer Test: **140909-A-VERT-2**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 131	***Initial Reading***	*-1.37*	*-1.47*	*-1.05*	*-1.39*	*-0.67*	*-1.01*	*0.00*
	1	1.00	0.50	0.00	-1.00	-1.00	-0.50	0.00
	2	2.00	0.50	0.00	-0.50	-1.00	-0.50	0.00
	3	3.00	0.50	0.00	-0.50	-1.00	-0.50	0.00
	4	1.50	0.00	0.00	-1.00	-1.00	-0.50	0.00
	5	1.00	0.00	-0.50	-1.00	-1.00	-0.50	0.00

		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 130	***Initial Reading***	*-1.05*	*-1.51*	*-0.30*	*-1.31*	*-1.25*	*-1.14*	*0.00*
	1	1.00	0.50	0.00	-1.00	-1.00	0.00	0.00
	2	2.00	1.50	0.00	-0.50	-1.00	-0.50	0.00
	3	2.50	1.50	0.50	-0.50	-1.00	-0.50	0.00
	4	1.50	1.00	0.00	-0.50	-1.00	-0.50	0.00
	5	1.00	0.75	-0.25	-0.75	-1.00	-0.50	0.00

		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 129	***Initial Reading***	*0.00*	*-1.75*	*0.00*	*0.00*	*-1.61*	*-1.47*	*-1.26*
	1	1.25	0.00	0.50	-0.50	-1.00	-0.50	-0.50
	2	2.00	0.00	0.00	0.00	-2.00	-1.00	-0.50
	3	2.00	1.00	0.00	1.00	-1.00	-0.50	0.00
	4	2.00	0.50	0.00	0.00	-1.00	-0.50	0.00
	5	1.00	0.00	0.00	0.00	-1.00	-0.50	-0.75

		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 128	***Initial Reading***	*-1.01*	*-1.41*	*0.00*	*0.00*	*-1.54*	*-0.91*	*-0.80*
	1	1.50	0.50	0.00	0.50	-1.00	-1.00	-0.50
	2	2.00	1.00	0.00	0.50	-0.75	-0.50	-0.50
	3	2.50	1.25	0.25	1.00	-0.50	-0.50	-0.25
	4	2.00	1.00	0.00	0.50	-0.75	-0.50	-0.50
	5	1.50	0.50	0.00	0.00	-1.00	-0.75	-1.00

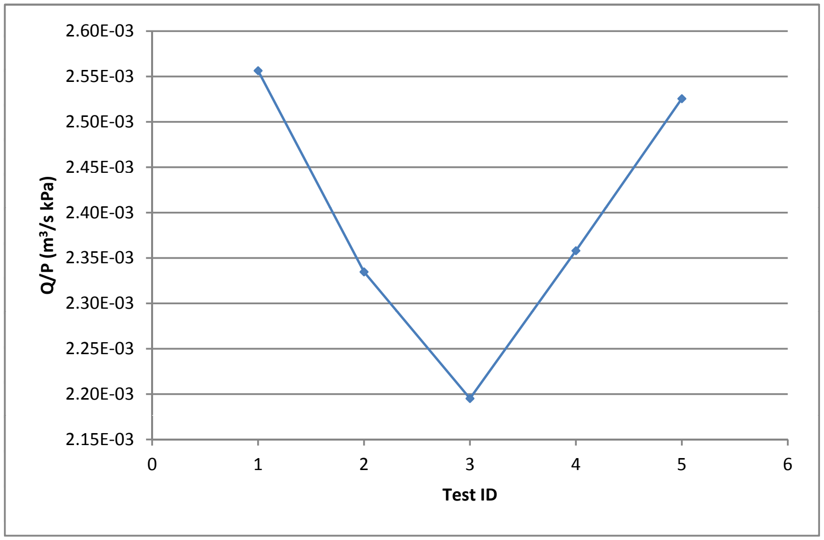
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

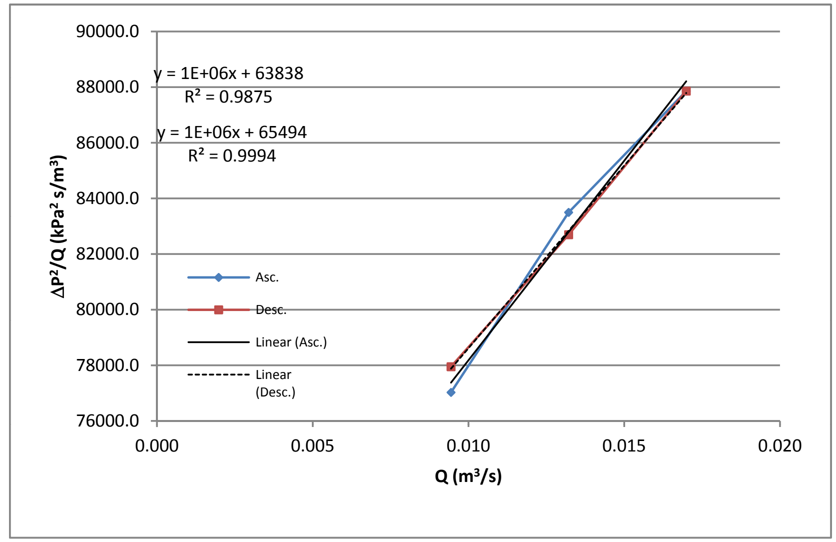
	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 131	1	2.37	1.97	1.05	0.39	-0.33	0.51	0.00
	2	3.37	1.97	1.05	0.89	-0.33	0.51	0.00
	3	4.37	1.97	1.05	0.89	-0.33	0.51	0.00
	4	2.87	1.47	1.05	0.39	-0.33	0.51	0.00
	5	2.37	1.47	0.55	0.39	-0.33	0.51	0.00

		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 130	1	2.05	2.01	0.30	0.31	0.25	1.14	0.00
	2	3.05	3.01	0.30	0.81	0.25	0.64	0.00
	3	3.55	3.01	0.80	0.81	0.25	0.64	0.00
	4	2.55	2.51	0.30	0.81	0.25	0.64	0.00
	5	2.05	2.26	0.05	0.56	0.25	0.64	0.00

		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 129	1	1.25	1.75	0.50	-0.50	0.61	0.97	0.76
	2	2.00	1.75	0.00	0.00	-0.39	0.47	0.76
	3	2.00	2.75	0.00	1.00	0.61	0.97	1.26
	4	2.00	2.25	0.00	0.00	0.61	0.97	1.26
	5	1.00	1.75	0.00	0.00	0.61	0.97	0.51

		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 128	1	2.51	1.91	0.00	0.50	0.54	-0.09	0.30
	2	3.01	2.41	0.00	0.50	0.79	0.41	0.30
	3	3.51	2.66	0.25	1.00	1.04	0.41	0.55
	4	3.01	2.41	0.00	0.50	0.79	0.41	0.30
	5	2.51	1.91	0.00	0.00	0.54	0.16	-0.20





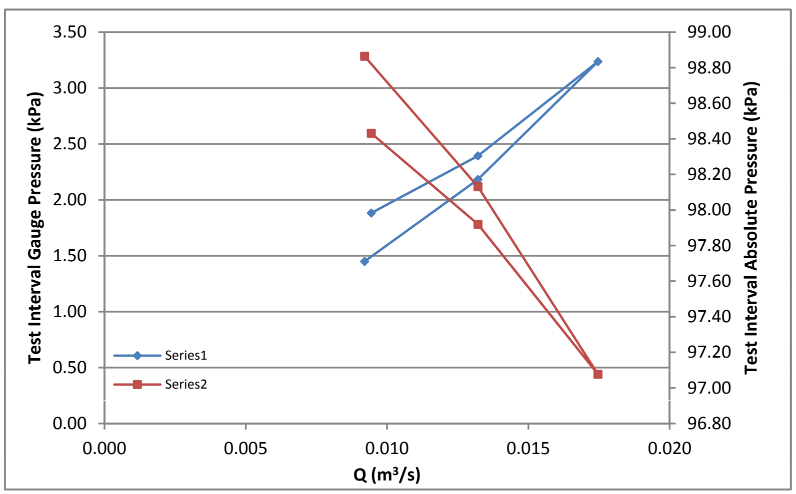
Q/P (m^3/s kPa)
2.56E-03
2.33E-03
2.20E-03
2.36E-03
2.53E-03

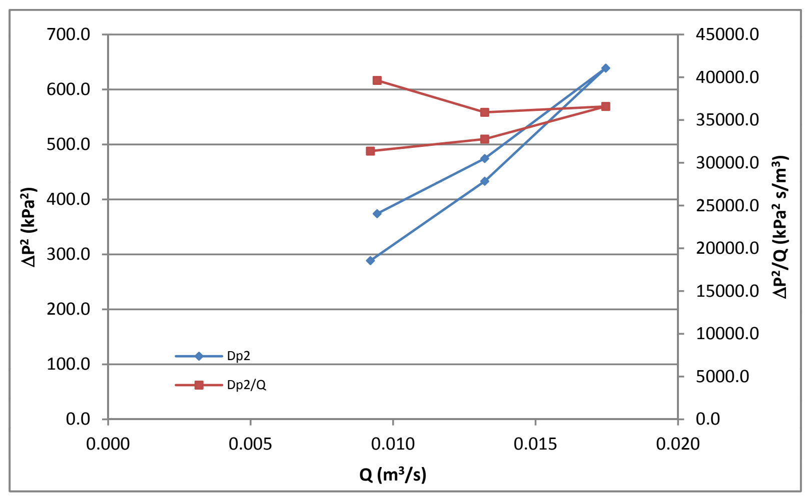
Packer Test:	140909-A-VERT-3
Client:	Syncrude Canada Ltd.

Test Date	14-Sep-09
Beginning Time	15:56:00
Ending Time	16:52:30
Test Interval Length (m)	1.38
Center of Test Interval (m)	4.49
Test Interval Temperature	7.6
Ambient Barometric Pressure (kPa)	100.3

Measurement	Depth (m)
Top of Upper Packer	2.94
Top of Test Interval	3.80
Bottom of Test Interva	5.18
Bottom of Lower Packe	6.04

Flow Rate ID	Begin Time (HH:MM:SS)	Ending Time (HH:MM:SS)	Pump Rate (ft^3/hr)	Pump Rate (m^3/s)	Transducer Output (mV)	Gauge Pressure (psi)	Gauge Pressure (psi)	Absolute Pressure (kPa)	ΔP^2 (kPa^2)	$\Delta P^2/Q$ ($kPa^2 s/m^3$)
1	15:56:30	16:05:15	1200	0.009	2471	0.27	1.88	98.43	374.1	39628.8
2	16:05:15	16:18:00	1680	0.013	2461.14	0.35	2.39	97.92	474.4	35901.0
3	16:22:00	16:33:30	2220	0.017	2444.87	0.47	3.24	97.08	638.9	36586.6
4	16:34:15	16:42:15	1680	0.013	2465.21	0.32	2.18	98.13	433.1	32770.9
5	16:42:15	16:52:15	1170	0.009	2479.35	0.21	1.45	98.86	288.7	31365.4





Packer Test: **140909-A-VERT-3**

Raw Data - Differential Manometer Measurement (mm H_2O)

CMT 131

Measurement ID	1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
Initial Reading	*-0.75*	*-0.63*	*-0.50*	*-0.75*	*-0.88*	*-1.25*	*-0.13*
1	0.00	0.00	-0.50	-0.75	-0.50	-0.75	0.00
2	0.50	0.00	0.00	-0.25	-0.50	-0.50	0.00
3	1.00	0.50	0.00	-0.25	-0.25	-0.25	0.00
4	0.75	0.00	0.25	-0.50	-0.75	-0.50	0.00
5	0.00	0.00	0.50	-0.50	-0.50	-0.50	0.00

CMT 130

	1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
Initial Reading	*-0.63*	*-0.63*	*-0.38*	*-0.75*	*-1.00*	*-0.75*	*-0.13*
1	0.00	1.75	0.50	-0.75	-1.50	-0.50	0.00
2	0.50	1.75	0.50	-0.50	-0.75	0.00	0.00
3	0.75	2.75	1.00	0.00	-0.50	0.00	0.00
4	0.75	2.00	0.50	-0.50	-1.00	0.00	0.00
5	0.00	1.50	0.50	-1.00	-1.00	-0.50	0.00

CMT 129

	1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
Initial Reading	*-0.50*	*-0.75*	*-0.25*	*0.25*	*-1.25*	*-0.88*	*0.00*
1	0.25	1.50	0.25	0.50	-1.00	-0.50	0.00
2	0.25	1.75	0.25	1.00	-0.75	-0.50	0.00
3	1.50	3.00	1.00	1.25	-0.50	-0.25	0.00
4	0.25	1.50	0.75	1.00	-0.25	-0.50	0.00
5	0.25	1.25	0.50	1.00	-0.50	-0.25	0.50

CMT 128

	1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
Initial Reading	*-0.38*	*-0.50*	*-0.25*	*0.25*	*-0.75*	*-0.75*	*-0.13*
1	0.25	2.00	0.25	0.75	-0.75	-0.50	-0.50
2	0.25	2.00	0.50	0.75	-1.00	-0.50	-0.50
3	1.75	3.00	1.00	1.00	-0.50	-0.25	0.00
4	0.75	3.00	1.00	1.00	-0.50	-0.25	0.25
5	0.50	2.00	0.75	1.00	-0.25	-0.25	0.25

Corrected Data - Net Differential Manometer Measurement (mm H_2O)

CMT 131

Measurement ID	1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
1	0.75	0.63	0.00	0.00	0.38	0.50	0.13
2	1.25	0.63	0.50	0.50	0.38	0.75	0.13
3	1.75	1.13	0.50	0.50	0.63	1.00	0.13
4	1.50	0.63	0.75	0.25	0.13	0.75	0.13
5	0.75	0.63	1.00	0.25	0.38	0.75	0.13

CMT 130

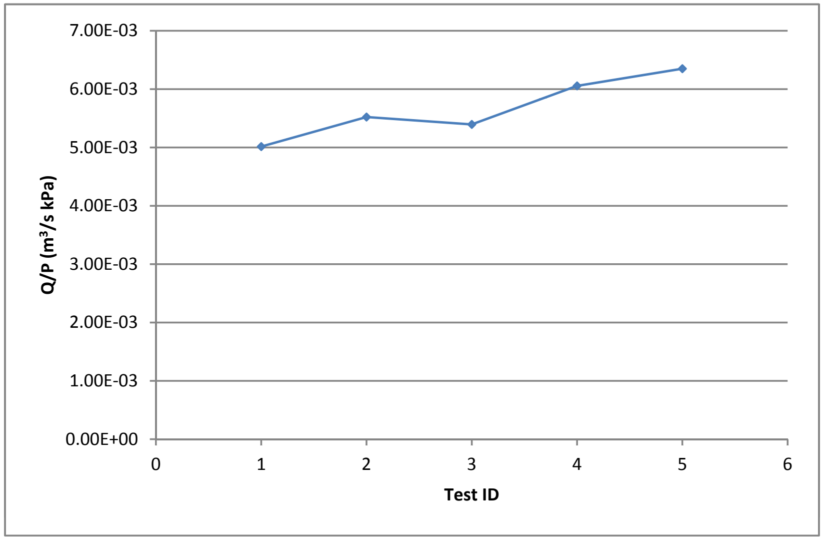
	1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
1	0.63	2.38	0.88	0.00	-0.50	0.25	0.13
2	1.13	2.38	0.88	0.25	0.25	0.75	0.13
3	1.38	3.38	1.38	0.75	0.50	0.75	0.13
4	1.38	2.63	0.88	0.25	0.00	0.75	0.13
5	0.63	2.13	0.88	-0.25	0.00	0.25	0.13

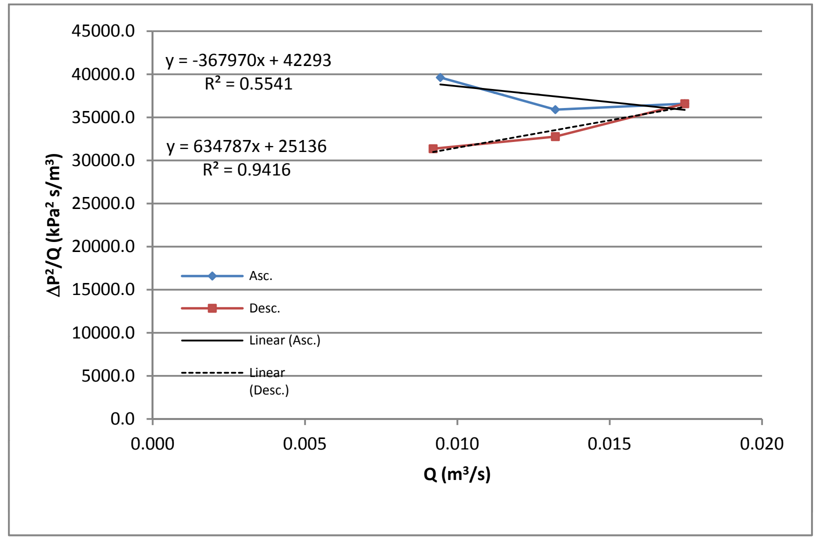
CMT 129

	1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
1	0.75	2.25	0.50	0.25	0.25	0.38	0.00
2	0.75	2.50	0.50	0.75	0.50	0.38	0.00
3	2.00	3.75	1.25	1.00	0.75	0.63	0.00
4	0.75	2.25	1.00	0.75	1.00	0.38	0.00
5	0.75	2.00	0.75	0.75	0.75	0.63	0.50

CMT 128

	1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
1	0.63	2.50	0.50	0.50	0.00	0.25	-0.38
2	0.63	2.50	0.75	0.50	-0.25	0.25	-0.38
3	2.13	3.50	1.25	0.75	0.25	0.50	0.13
4	1.13	3.50	1.25	0.75	0.25	0.50	0.38
5	0.88	2.50	1.00	0.75	0.50	0.50	0.38





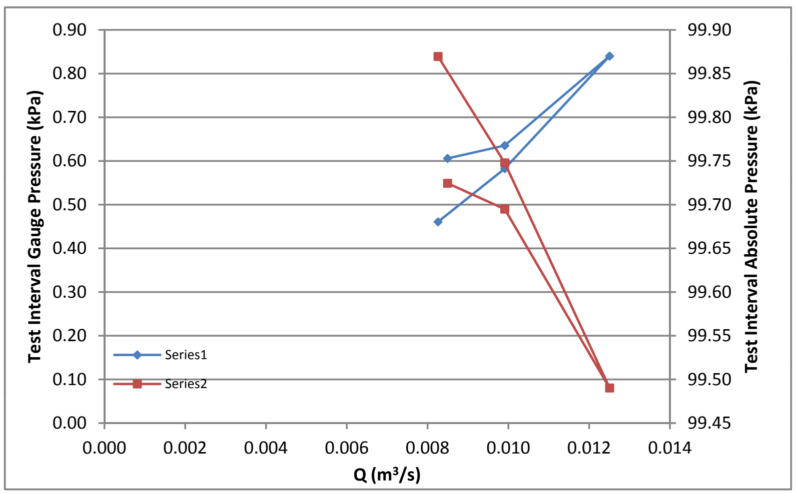
Q/P (m^3/s kPa)
5.02E-03
5.52E-03
5.40E-03
6.06E-03
6.35E-03

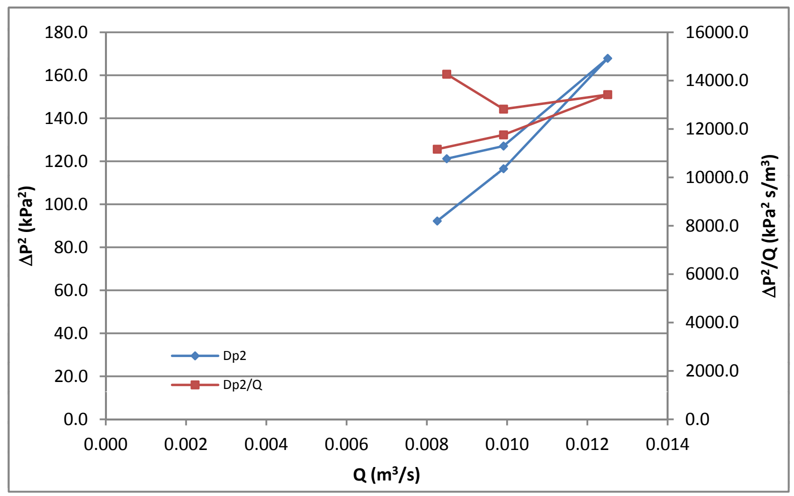
Packer Test: **140909-A-VERT-4**

Client:	Syncrude Canada Ltd.
Test Date	14-Sep-09
Beginning Time	16:59:00
Ending Time	17:47:45
Test Interval Length (m)	1.38
Center of Test Interval (m)	5.87
Test Interval Temperature	8.1
Ambient Barometric Pressure (kPa)	100.3

Measurement	**Depth** (m)
Top of Upper Packer	4.32
Top of Test Interval	5.18
Bottom of Test Interva	6.56
Bottom of Lower Packe	7.42

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (psi)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2 s/m^3$)
1	17:01:00	17:04:30	1080	0.008	2495.62	0.09	0.61	99.72	121.2	14266.9
2	17:04:30	17:10:00	1260	0.010	2495.05	0.09	0.64	99.69	127.1	12823.3
3	17:10:00	17:27:30	1590	0.013	2491.1	0.12	0.84	99.49	167.9	13423.0
4	17:27:30	17:38:15	1260	0.010	2496.07	0.08	0.58	99.75	116.5	11759.2
5	17:38:15	17:47:45	1050	0.008	2498.42	0.07	0.46	99.87	92.2	11166.8





Packer Test: **140909-A-VERT-4**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 131	***Initial Reading***	*-0.75*	*-0.63*	*-0.50*	*-0.75*	*-0.88*	*-1.25*	*-0.13*
	1	-0.50	0.25	0.00	-0.50	-0.25	-0.50	0.00
	2	-0.25	0.00	-0.50	0.00	0.00	0.00	0.00
	3	0.00	0.50	0.00	0.25	0.00	-0.50	0.00
	4	0.00	0.50	1.50	0.00	-0.25	0.00	0.00
	5	-0.25	0.00	2.00	0.00	-0.25	0.00	0.00

		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 130	***Initial Reading***	*-0.63*	*-0.63*	*-0.38*	*-0.75*	*-1.00*	*-0.75*	*-0.13*
	1	-0.25	0.50	1.25	0.00	-0.50	-0.50	0.00
	2	-0.25	1.00	2.00	0.00	-0.25	0.00	0.00
	3	0.00	1.25	3.00	0.75	0.00	0.25	0.00
	4	0.00	1.00	2.50	0.50	-0.50	-0.25	0.00
	5	-0.25	0.50	1.75	0.00	-0.50	-0.50	0.00

		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 129	***Initial Reading***	*-0.38*	*-0.75*	*-0.25*	*0.25*	*-0.63*	*-0.63*	*0.00*
	1	0.00	0.50	1.50	1.00	-0.25	-0.50	0.00
	2	0.00	0.50	1.75	1.25	-0.25	-0.50	0.00
	3	0.00	1.00	2.50	1.00	-0.25	-0.50	0.50
	4	0.00	1.00	2.00	1.25	-0.25	-0.50	0.50
	5	0.00	0.50	1.25	1.25	-0.25	-0.50	0.75

		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 128	***Initial Reading***	*-0.38*	*-0.50*	*-0.25*	*0.25*	*-0.75*	*-0.75*	*-0.13*
	1	0.00	0.75	2.00	1.00	0.00	-0.50	0.00
	2	0.00	1.00	2.75	1.50	0.00	-0.50	0.50
	3	0.25	1.50	3.00	1.75	0.00	-0.50	0.50
	4	0.00	1.00	2.50	1.50	0.00	-0.50	0.50
	5	0.00	0.50	2.25	1.50	0.00	-0.50	0.50

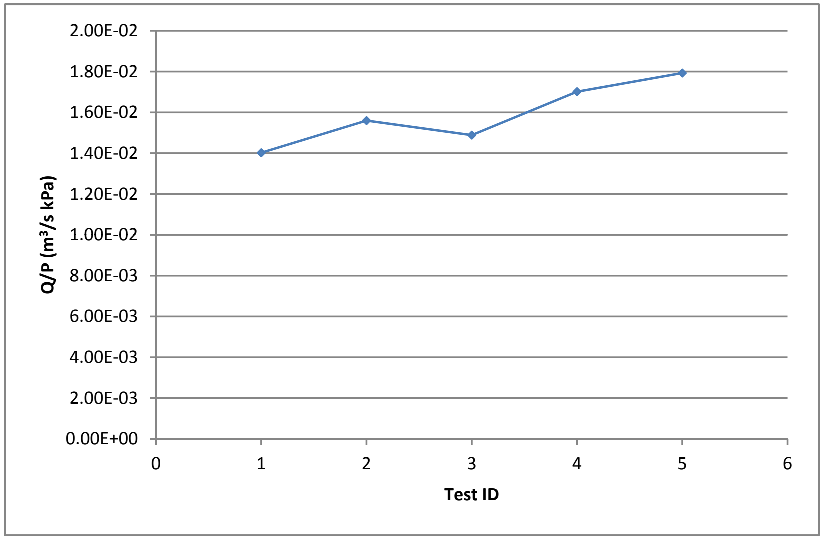
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

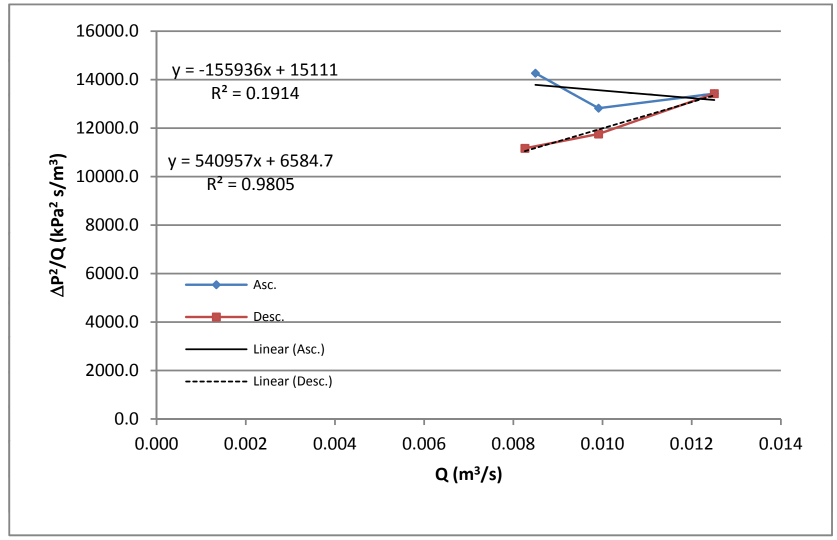
	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 131	1	0.25	0.88	0.50	0.25	0.63	0.75	0.13
	2	0.50	0.63	0.00	0.75	0.88	1.25	0.13
	3	0.75	1.13	0.50	1.00	0.88	0.75	0.13
	4	0.75	1.13	2.00	0.75	0.63	1.25	0.13
	5	0.50	0.63	2.50	0.75	0.63	1.25	0.13

		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 130	1	0.38	1.13	1.63	0.75	0.50	0.25	0.13
	2	0.38	1.63	2.38	0.75	0.75	0.75	0.13
	3	0.63	1.88	3.38	1.50	1.00	1.00	0.13
	4	0.63	1.63	2.88	1.25	0.50	0.50	0.13
	5	0.38	1.13	2.13	0.75	0.50	0.25	0.13

		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 129	1	0.38	1.25	1.75	0.75	0.38	0.13	0.00
	2	0.38	1.25	2.00	1.00	0.38	0.13	0.00
	3	0.38	1.75	2.75	0.75	0.38	0.13	0.50
	4	0.38	1.75	2.25	1.00	0.38	0.13	0.50
	5	0.38	1.25	1.50	1.00	0.38	0.13	0.75

		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 128	1	0.38	1.25	2.25	0.75	0.75	0.25	0.13
	2	0.38	1.50	3.00	1.25	0.75	0.25	0.63
	3	0.63	2.00	3.25	1.50	0.75	0.25	0.63
	4	0.38	1.50	2.75	1.25	0.75	0.25	0.63
	5	0.38	1.00	2.50	1.25	0.75	0.25	0.63





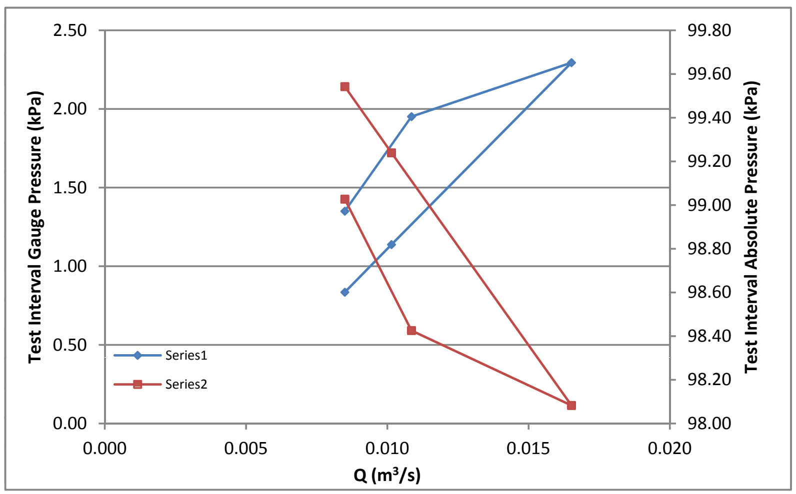
Q/P (m^3/s kPa)
1.40E-02
1.56E-02
1.49E-02
1.70E-02
1.79E-02

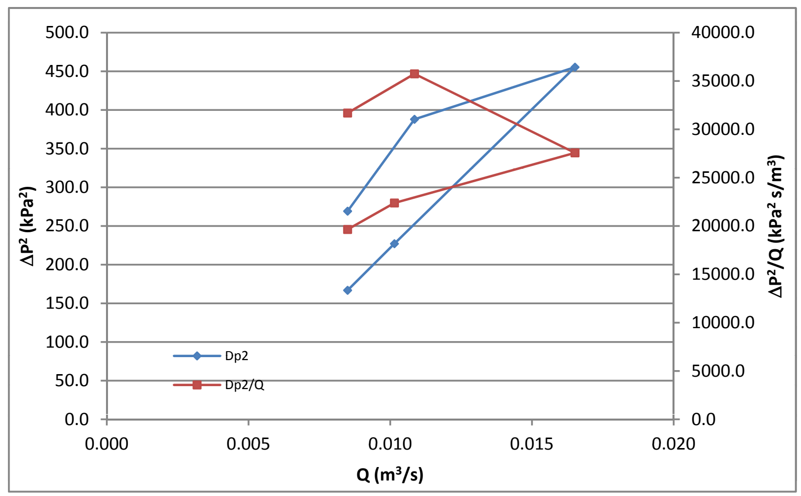
Packer Test:	**140909-A-VERT-5**
Client:	Syncrude Canada Ltd.

Test Date	14-Sep-09
Beginning Time	17:59:45
Ending Time	18:53:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	7.25
Test Interval Temperature	8.6
Ambient Barometric Pressure (kPa)	100.4

Measurement	**Depth** (m)
Top of Upper Packer	5.70
Top of Test Interval	6.56
Bottom of Test Interva	7.94
Bottom of Lower Packe	8.80

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (psi)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2 s/m^3$)
1	18:00:00	18:09:30	1080	0.008	2480.18	0.20	1.35	99.03	269.2	31685.3
2	18:10:15	18:18:00	1380	0.011	2468.27	0.28	1.95	98.43	388.0	35740.5
3	18:18:00	18:29:00	2100	0.017	2461.48	0.33	2.29	98.08	455.4	27566.8
4	18:29:00	18:41:30	1290	0.010	2484.38	0.16	1.14	99.24	227.1	22381.9
5	18:41:30	18:53:00	1080	0.008	2490.38	0.12	0.83	99.54	166.9	19642.2





Packer Test: **140909-A-VERT-5**

Raw Data - Differential Manometer Measurement (mm H_2O)

CMT 131

Measurement ID	1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
Initial Reading	*-0.75*	*-0.63*	*-0.50*	*-0.75*	*-0.88*	*-1.25*	*-0.13*
1	0.00	0.00	2.00	1.50	0.50	1.50	0.50
2	-0.25	0.25	3.00	2.00	0.50	1.75	0.50
3	0.00	0.50	3.50	4.00	1.50	2.50	0.50
4	0.00	0.50	2.00	2.25	1.75	1.00	0.50
5	0.00	0.50	1.75	1.50	0.50	1.00	0.50

Gas Port Number [Measurement Depth (m)]

CMT 130

	1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
Initial Reading	*-0.63*	*-0.63*	*-0.38*	*-0.75*	*-1.00*	*-0.75*	*-0.13*
1	-0.50	0.50	2.00	1.50	0.00	0.50	0.50
2	-0.50	0.50	2.50	2.00	0.50	0.50	0.50
3	0.00	0.50	3.50	4.00	1.50	2.50	0.75
4	0.00	0.75	2.25	2.50	0.50	3.50	0.50
5	-0.25	0.50	1.75	1.75	0.25	0.50	0.50

CMT 129

	1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
Initial Reading	*-0.38*	*-0.75*	*-0.25*	*0.25*	*-0.63*	*-0.63*	*0.00*
1	0.00	0.25	2.50	2.00	0.50	-0.50	1.00
2	0.00	0.50	2.50	2.75	0.50	0.00	1.00
3	0.00	1.00	3.00	4.00	0.75	0.25	1.00
4	0.00	0.50	2.50	2.75	0.50	0.25	0.25
5	0.00	0.25	2.00	2.25	0.50	-0.25	0.25

CMT 128

	1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
Initial Reading	*-0.38*	*-0.50*	*-0.25*	*0.25*	*-0.75*	*-0.75*	*-0.13*
1	0.00	-0.50	1.50	2.50	0.50	-0.25	0.50
2	0.00	-0.50	2.50	3.00	0.75	0.00	0.75
3	0.00	0.00	3.00	5.00	2.00	1.00	1.00
4	0.00	0.50	2.00	2.50	0.50	0.75	0.50
5	0.00	0.20	1.25	3.00	0.50	0.50	0.75

Corrected Data - Net Differential Manometer Measurement (mm H_2O)

Gas Port Number [Measurement Depth (m)]

CMT 131

Measurement ID	1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
1	0.75	0.63	2.50	2.25	1.38	2.75	0.63
2	0.50	0.88	3.50	2.75	1.38	3.00	0.63
3	0.75	1.13	4.00	4.75	2.38	3.75	0.63
4	0.75	1.13	2.50	3.00	2.63	2.25	0.63
5	0.75	1.13	2.25	2.25	1.38	2.25	0.63

CMT 130

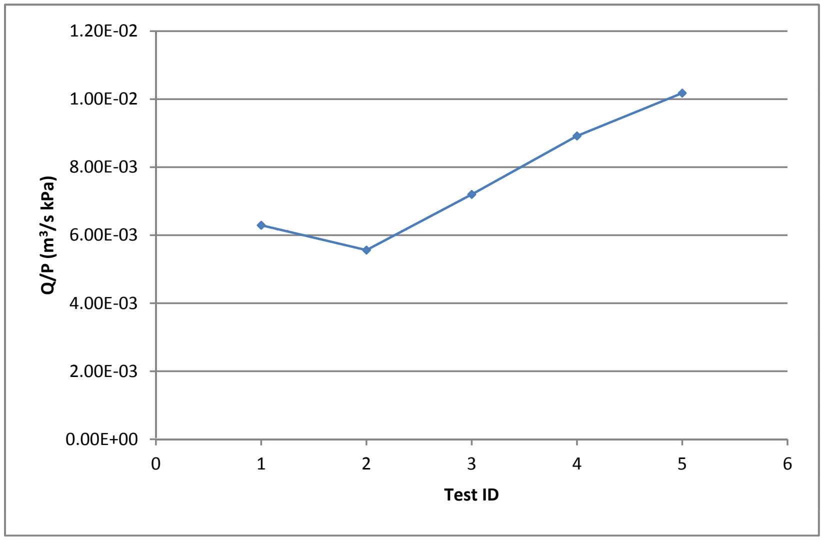
	1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
1	0.13	1.13	2.38	2.25	1.00	1.25	0.63
2	0.13	1.13	2.88	2.75	1.50	1.25	0.63
3	0.63	1.13	3.88	4.75	2.50	3.25	0.88
4	0.63	1.38	2.63	3.25	1.50	4.25	0.63
5	0.38	1.13	2.13	2.50	1.25	1.25	0.63

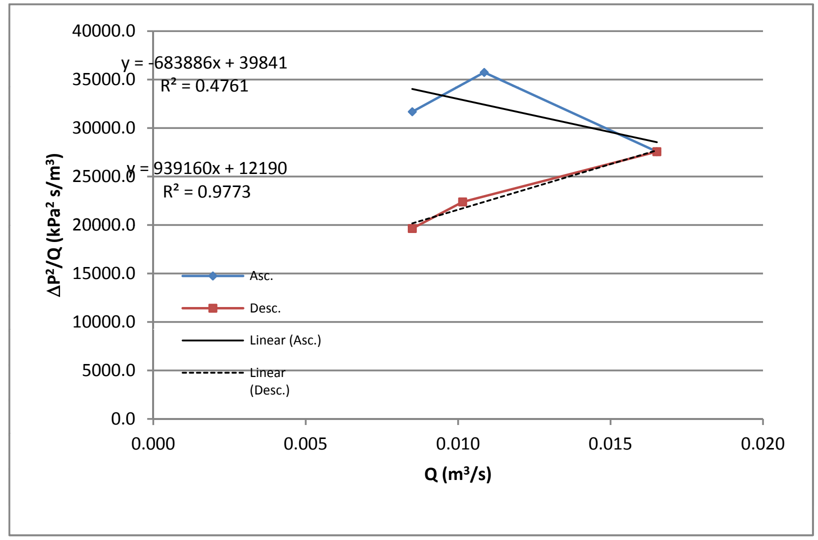
CMT 129

	1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
1	0.38	1.00	2.75	1.75	1.13	0.13	1.00
2	0.38	1.25	2.75	2.50	1.13	0.63	1.00
3	0.38	1.75	3.25	3.75	1.38	0.88	1.00
4	0.38	1.25	2.75	2.50	1.13	0.88	0.25
5	0.38	1.00	2.25	2.00	1.13	0.38	0.25

CMT 128

	1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4]	6 [12.4]	7 [14.4]
1	0.38	0.00	1.75	2.25	1.25	0.50	0.63
2	0.38	0.00	2.75	2.75	1.50	0.75	0.88
3	0.38	0.50	3.25	4.75	2.75	1.75	1.13
4	0.38	1.00	2.25	2.25	1.25	1.50	0.63
5	0.38	0.70	1.50	2.75	1.25	1.25	0.88





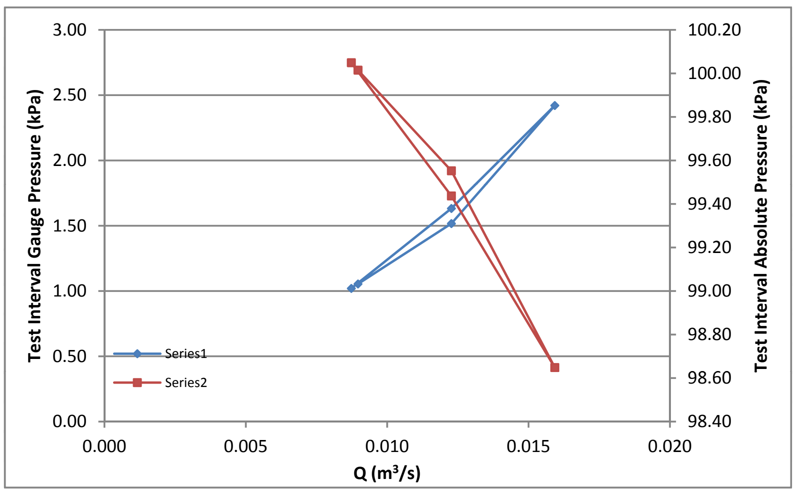
Q/P (m^3/s kPa)
6.29E-03
5.56E-03
7.20E-03
8.92E-03
1.02E-02

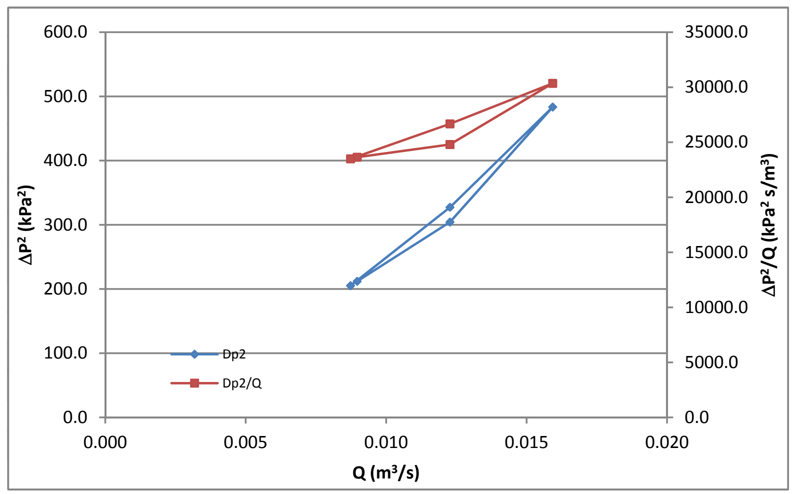
Packer Test:	150909-A-VERT-1
Client:	Syncrude Canada Ltd.

Test Date	15-Sep-09
Beginning Time	10:15:30
Ending Time	11:04:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	8.63
Test Interval Temperature	9.2
Ambient Barometric Pressure (kPa)	101.1

Measurement	Depth (m)
Top of Upper Packer	7.08
Top of Test Interval	7.94
Bottom of Test Interva	9.32
Bottom of Lower Packe	10.18

Flow Rate ID	Begin Time (HH:MM:SS)	Ending Time (HH:MM:SS)	Pump Rate (ft^3/hr)	Pump Rate (m^3/s)	Transducer Output (mV)	Gauge Pressure (psi)	Gauge Pressure (psi)	Absolute Pressure (kPa)	ΔP^2 (kPa^2)	$\Delta P^2/Q$ ($kPa^2\ s/m^3$)
1	10:20:30	10:29:45	1140	0.009	2486.97	0.15	1.05	100.02	212.0	23640.9
2	10:29:45	10:39:30	1560	0.012	2478.05	0.22	1.52	99.55	304.3	24796.4
3	10:39:30	10:47:45	2025	0.016	2460.61	0.35	2.42	98.65	483.5	30352.0
4	10:47:45	10:56:15	1560	0.012	2475.82	0.24	1.63	99.44	327.3	26671.1
5	10:56:15	11:04:00	1110	0.009	2487.63	0.15	1.02	100.05	205.1	23495.9





Packer Test: **150909-A-VERT-1**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)] 1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4	6 [12.4]	7 [14.4]
CMT 131	***Initial Reading***	*-1.00*	*0.00*	*-0.50*	*-0.50*	*-0.75*	*0.25*	*0.00*
	1	-0.75	0.75	0.75	3.00	1.50	1.00	0.50
	2	-0.50	0.75	0.75	3.50	1.50	1.00	0.50
	3	-0.25	0.75	1.00	5.00	1.75	0.75	0.50
	4	-1.00	0.50	0.75	4.00	1.75	0.75	0.50
	5	-0.50	0.50	0.50	3.00	1.50	1.00	0.50

		1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4	6 [12.4]	7 [14.4]
CMT 130	***Initial Reading***	*-0.75*	*0.00*	*-0.25*	*-1.00*	*-0.50*	*-0.25*	*0.25*
	1	-0.50	0.00	1.00	3.00	1.50	1.00	0.75
	2	-0.50	0.50	1.00	4.00	1.50	1.00	0.75
	3	-0.50	0.75	1.50	5.00	2.00	1.00	0.75
	4	-0.50	0.50	1.00	4.00	1.75	0.75	0.50
	5	-0.50	0.50	0.50	3.00	1.50	0.75	0.50

		1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4	6 [12.4]	7 [14.4]
CMT 129	***Initial Reading***	*-0.75*	*-0.75*	*0.25*	*0.75*	*0.50*	*-0.25*	*0.00*
	1	-1.00	-0.75	0.75	3.00	1.00	0.25	0.50
	2	-0.50	-0.75	1.00	4.00	1.50	0.50	0.75
	3	-0.25	-0.75	1.50	5.50	1.75	0.50	0.75
	4	-0.50	-0.50	1.00	4.00	1.75	0.25	0.50
	5	-0.50	-0.75	0.75	3.00	1.00	0.25	0.25

		1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4	6 [12.4]	7 [14.4]
CMT 128	***Initial Reading***	*-1.00*	*-1.00*	*0.00*	*0.50*	*0.00*	*-0.50*	*0.00*
	1	-1.00	-1.00	1.00	5.00	1.00	0.50	0.50
	2	-0.50	-0.75	1.00	5.50	2.00	0.50	0.50
	3	-0.25	-0.50	1.00	6.50	2.00	0.50	0.75
	4	-0.50	-0.50	0.75	5.50	2.00	0.50	0.50
	5	-0.50	-0.50	0.75	4.50	2.00	0.50	0.50

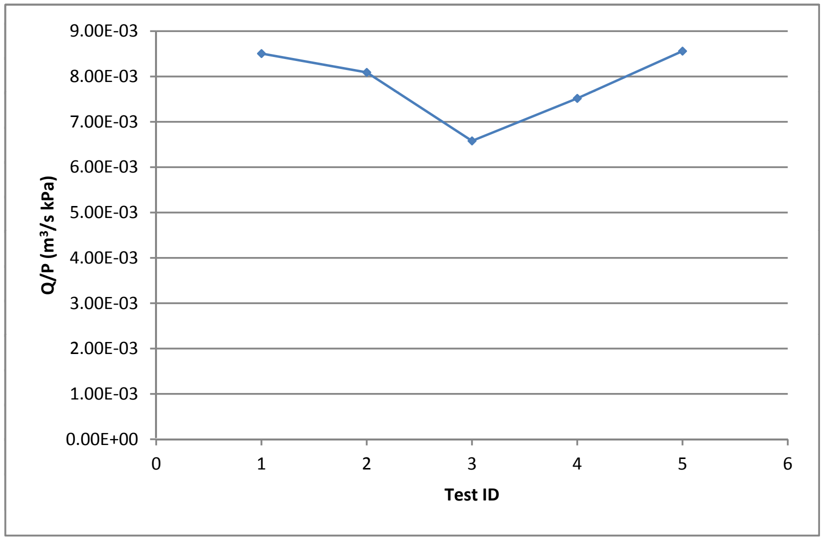
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

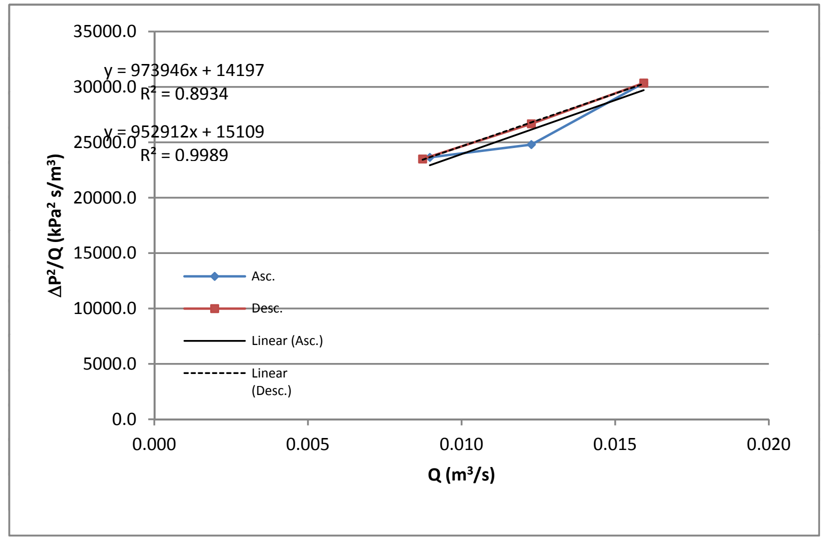
	Measuremen t ID	Gas Port Number [Measurement Depth (m)] 1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4	6 [12.4]	7 [14.4]
CMT 131	1	0.25	0.75	1.25	3.50	2.25	0.75	0.50
	2	0.50	0.75	1.25	4.00	2.25	0.75	0.50
	3	0.75	0.75	1.50	5.50	2.50	0.50	0.50
	4	0.00	0.50	1.25	4.50	2.50	0.50	0.50
	5	0.50	0.50	1.00	3.50	2.25	0.75	0.50

		1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4	6 [12.4]	7 [14.4]
CMT 130	1	0.25	0.00	1.25	4.00	2.00	1.25	0.50
	2	0.25	0.50	1.25	5.00	2.00	1.25	0.50
	3	0.25	0.75	1.75	6.00	2.50	1.25	0.50
	4	0.25	0.50	1.25	5.00	2.25	1.00	0.25
	5	0.25	0.50	0.75	4.00	2.00	1.00	0.25

		1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4	6 [12.4]	7 [14.4]
CMT 129	1	-0.25	0.00	0.50	2.25	0.50	0.50	0.50
	2	0.25	0.00	0.75	3.25	1.00	0.75	0.75
	3	0.50	0.00	1.25	4.75	1.25	0.75	0.75
	4	0.25	0.25	0.75	3.25	1.25	0.50	0.50
	5	0.25	0.00	0.50	2.25	0.50	0.50	0.25

		1 [2.4]	2 [4.4]	3 [6.4]	4 [8.4]	5 [10.4	6 [12.4]	7 [14.4]
CMT 128	1	0.00	0.00	1.00	4.50	1.00	1.00	0.50
	2	0.50	0.25	1.00	5.00	2.00	1.00	0.50
	3	0.75	0.50	1.00	6.00	2.00	1.00	0.75
	4	0.50	0.50	0.75	5.00	2.00	1.00	0.50
	5	0.50	0.50	0.75	4.00	2.00	1.00	0.50





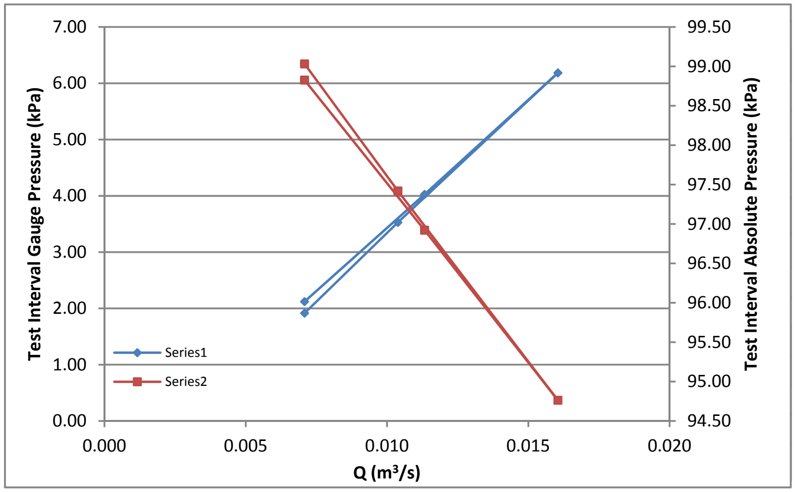
Q/P (m^3/s kPa)
8.51E-03
8.09E-03
6.58E-03
7.52E-03
8.56E-03

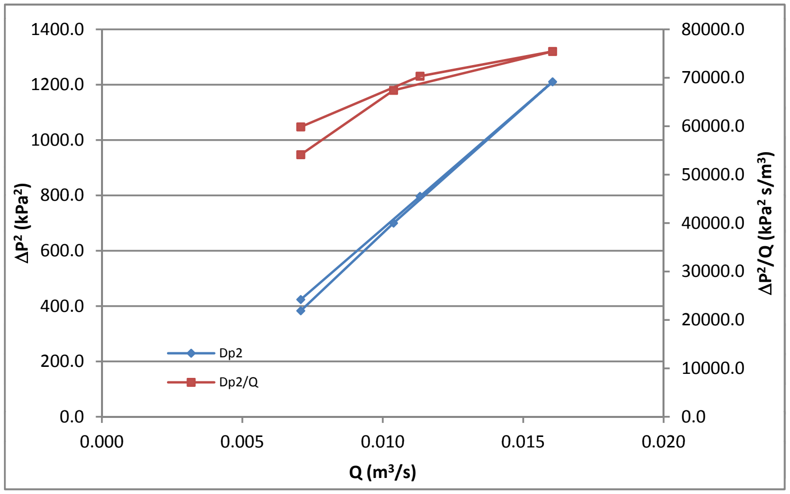
Packer Test:	**150909-A-VERT-2**
Client:	Syncrude Canada Ltd.

Test Date	15-Sep-09
Beginning Time	13:06:00
Ending Time	13:54:15
Test Interval Length (m)	1.38
Center of Test Interval (m)	10.01
Test Interval Temperature	10.3
Ambient Barometric Pressure (kPa)	100.9

Measurement	**Depth** (m)
Top of Upper Packer	8.46
Top of Test Interval	9.32
Bottom of Test Interva	10.70
Bottom of Lower Packe	11.56

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (psi)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2 s/m^3$)
1	13:09:00	13:17:45	900	0.007	2466.39	0.31	2.12	98.83	423.7	59856.1
2	13:19:30	13:27:45	1440	0.011	2429.65	0.58	4.03	96.92	796.5	70324.4
3	13:28:30	13:36:30	2040	0.016	2388	0.89	6.18	94.76	1210.4	75432.6
4	13:37:00	13:46:15	1320	0.010	2439.25	0.51	3.53	97.42	699.8	67402.7
5	13:46:15	13:54:15	900	0.007	2470.35	0.28	1.92	99.03	383.1	54118.6





Packer Test: **150909-A-VERT-2**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 131	***Initial Reading***	*-0.25*	*0.00*	*0.00*	*0.25*	*0.50*	*0.50*	*0.00*
	1	0.00	0.75	0.75	2.00	4.50	1.75	0.00
	2	-0.25	0.50	0.25	2.75	5.00	2.50	0.00
	3	-0.25	0.75	0.50	4.00	6.50	3.50	0.50
	4	-0.50	0.25	0.25	2.50	5.00	2.50	0.00
	5	-0.50	0.25	0.25	2.00	3.00	1.50	0.00

		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 130	***Initial Reading***	*-0.25*	*0.25*	*0.00*	*0.50*	*0.50*	*0.25*	*-0.50*
	1	-0.25	0.25	0.25	1.50	3.00	1.25	0.00
	2	-0.50	0.50	0.25	2.50	5.00	2.50	0.00
	3	-0.50	0.25	0.50	3.75	7.50	3.50	1.00
	4	-0.50	0.25	0.25	2.50	5.50	2.50	0.50
	5	-0.50	0.25	0.25	1.50	3.00	1.50	0.00

		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 129	***Initial Reading***	*-0.50*	*-0.25*	*0.00*	*0.50*	*0.00*	*0.00*	*0.25*
	1	-0.25	0.00	0.25	2.00	2.00	2.00	1.50
	2	-0.50	0.00	0.25	3.50	3.75	2.00	1.50
	3	-0.50	0.00	0.25	3.75	4.00	2.00	1.50
	4	-0.50	-0.25	0.25	3.00	2.75	1.00	0.50
	5	-0.50	-0.50	0.25	2.00	2.00	0.50	0.50

		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 128	***Initial Reading***	*-1.00*	*-0.50*	*0.00*	*0.50*	*0.25*	*0.00*	*0.25*
	1	-0.50	-0.50	0.25	2.00	2.50	1.50	0.25
	2	-0.50	-0.50	0.25	2.75	3.75	1.25	0.25
	3	-0.50	-0.50	0.25	3.50	4.50	2.00	0.75
	4	-0.50	-0.50	0.25	2.50	3.00	1.50	0.25
	5	-0.50	-0.75	0.25	2.00	2.00	1.00	0.25

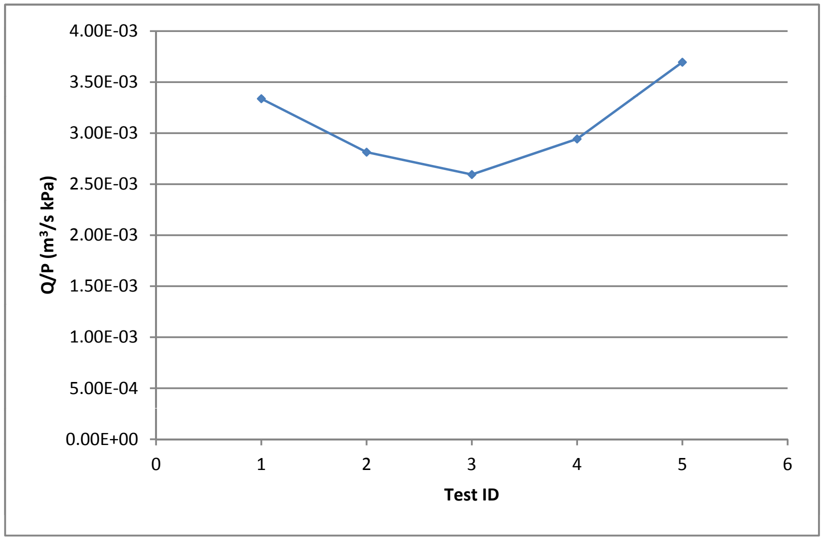
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

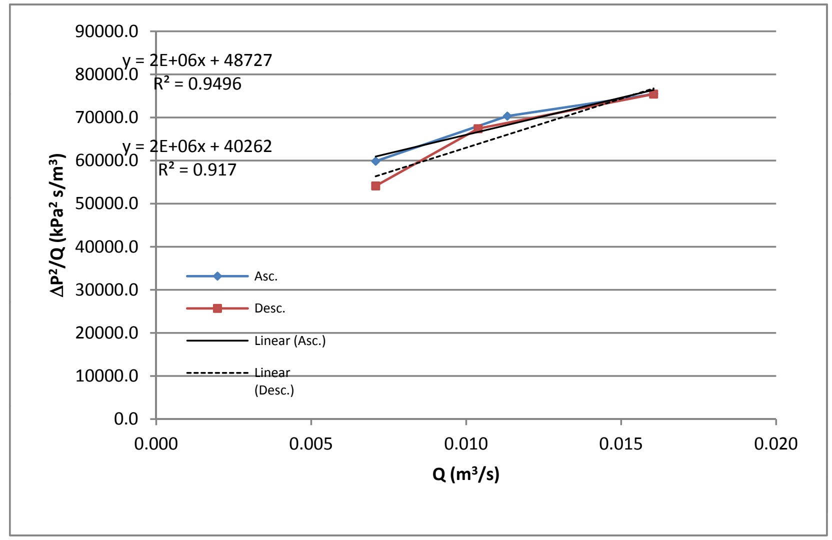
	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 131	1	0.25	0.75	0.75	1.75	4.00	1.25	0.00
	2	0.00	0.50	0.25	2.50	4.50	2.00	0.00
	3	0.00	0.75	0.50	3.75	6.00	3.00	0.50
	4	-0.25	0.25	0.25	2.25	4.50	2.00	0.00
	5	-0.25	0.25	0.25	1.75	2.50	1.00	0.00

		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 130	1	0.00	0.00	0.25	1.00	2.50	1.00	0.50
	2	-0.25	0.25	0.25	2.00	4.50	2.25	0.50
	3	-0.25	0.00	0.50	3.25	7.00	3.25	1.50
	4	-0.25	0.00	0.25	2.00	5.00	2.25	1.00
	5	-0.25	0.00	0.25	1.00	2.50	1.25	0.50

		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 129	1	0.25	0.25	0.25	1.50	2.00	2.00	1.25
	2	0.00	0.25	0.25	3.00	3.75	2.00	1.25
	3	0.00	0.25	0.25	3.25	4.00	2.00	1.25
	4	0.00	0.00	0.25	2.50	2.75	1.00	0.25
	5	0.00	-0.25	0.25	1.50	2.00	0.50	0.25

		1 [2.4]	**2 [4.4]**	**3 [6.4]**	**4 [8.4]**	**5 [10.4]**	**6 [12.4]**	**7 [14.4]**
CMT 128	1	0.50	0.00	0.25	1.50	2.25	1.50	0.00
	2	0.50	0.00	0.25	2.25	3.50	1.25	0.00
	3	0.50	0.00	0.25	3.00	4.25	2.00	0.50
	4	0.50	0.00	0.25	2.00	2.75	1.50	0.00
	5	0.50	-0.25	0.25	1.50	1.75	1.00	0.00





Q/P (m^3/s kPa)
3.34E-03
2.81E-03
2.59E-03
2.94E-03
3.70E-03

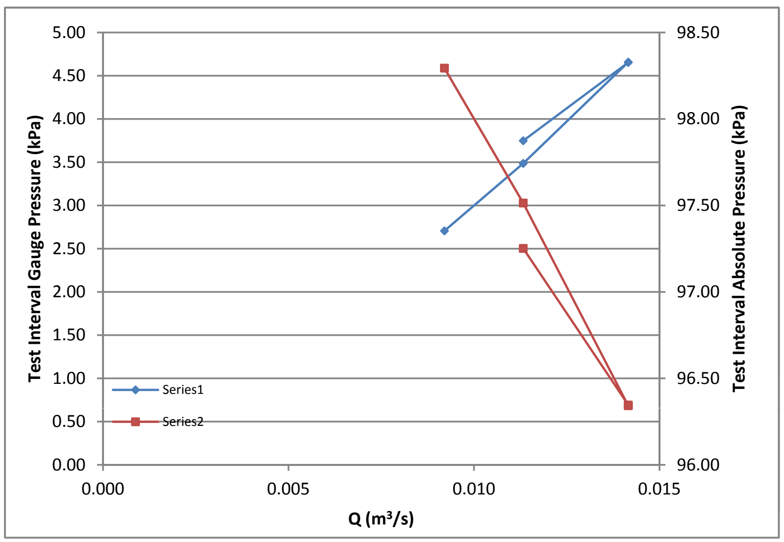
Packer Test:	**150909-A-Ang-1**
Client:	Syncrude Canada Ltd.
Test Date	15-Sep-09
Beginning Time	16:22:00
Ending Time	18:09:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	1.66
Test Interval Temperature	16.0
Ambient Barometric Pressure (kPa	101.0

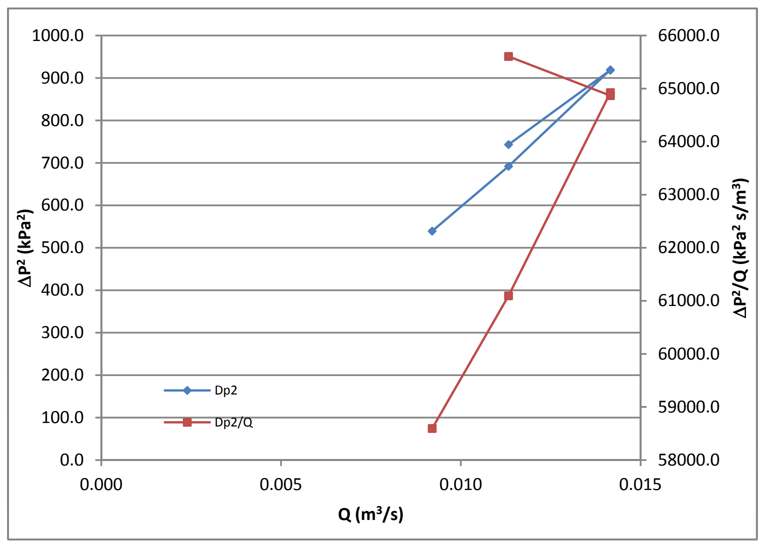
Measurement	**Depth** (m)
Top of Upper Packer	0.31
Top of Test Interval	1.17
Bottom of Test Interval	2.15
Bottom of Lower Packer	3.01

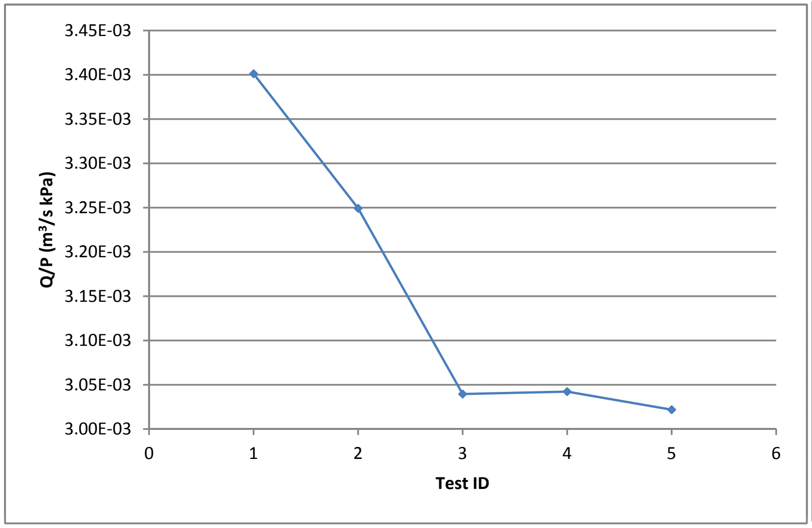
Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\ s/m^3$)
1	16:27:30	16:36:15	1170	0.009	2455.11	0.39	2.71	98.29	539.2	58595.1
2	16:37:15	16:46:15	1440	0.011	2440.06	0.50	3.49	97.51	692.0	61095.5
3	16:46:15	16:53:15	1800	0.014	2417.45	0.67	4.66	96.34	919.2	64924.3
4	17:43:30	17:56:30	1800	0.014	2417.53	0.67	4.65	96.35	918.4	64867.8
5	17:56:30	18:09:00	1440	0.011	2435.00	0.54	3.75	97.25	743.1	65605.9

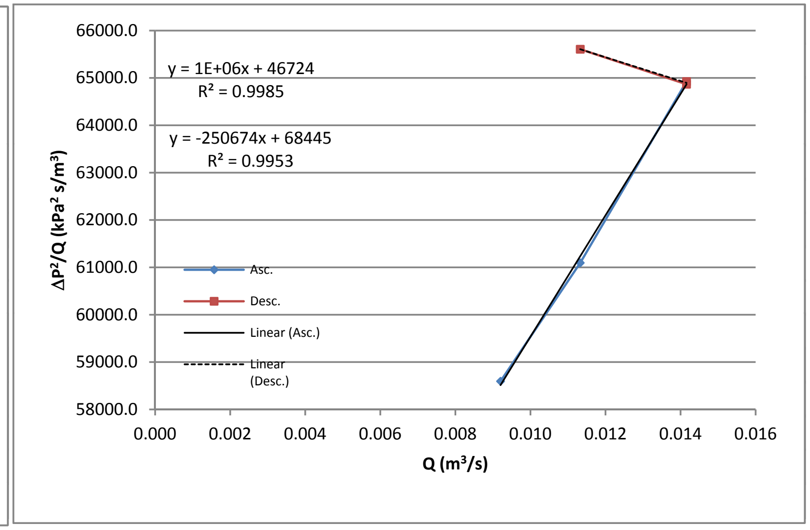
Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.









Q/P (m^3/s kPa)
3.40E-03
3.25E-03
3.04E-03
3.04E-03
3.02E-03

Packer Test: **160909-A-Ang-1**

Client: Syncrude Canada Ltd.

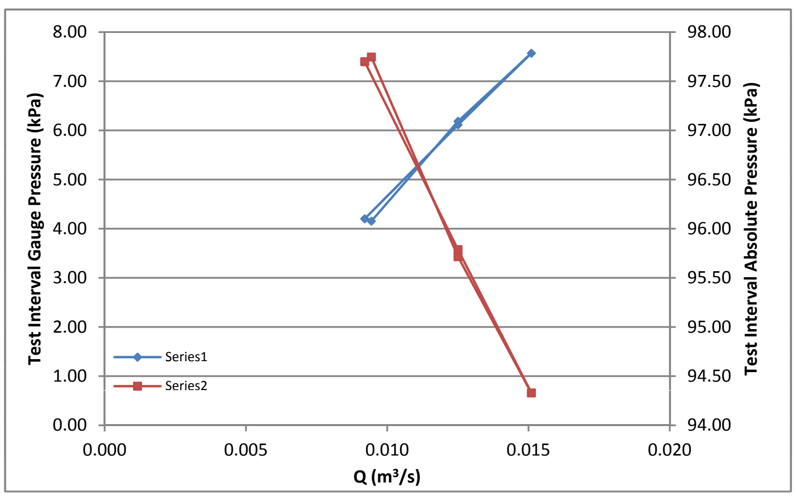
Test Date	16-Sep-09
Beginning Time	11:11:00
Ending Time	11:40:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	2.64
Test Interval Temperature	10.1
Ambient Barometric Pressure (kPa)	101.9

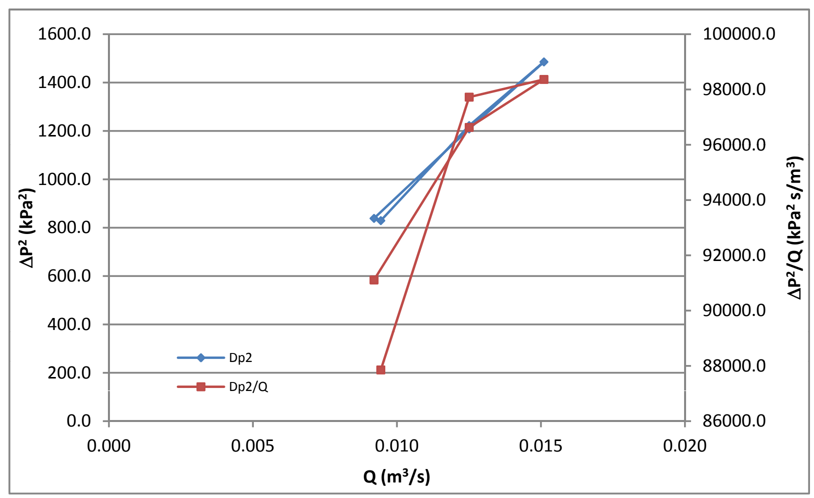
Measurement	**Depth** (m)
Top of Upper Packer	1.29
Top of Test Interval	2.15
Bottom of Test Interval	3.13
Bottom of Lower Packer	3.99

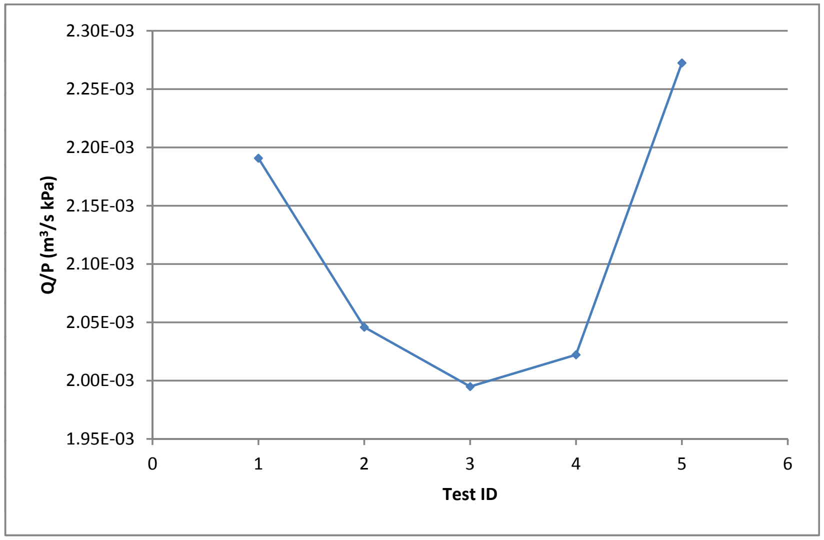
Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	ΔP^2 (kPa^2)	$\Delta P^2/Q$ ($kPa^2 s/m^3$)
1	11:19:30	11:25:15	1170	0.009	2426.27	0.61	4.20	97.70	838.5	91109.6
2	11:25:15	11:31:00	1590	0.013	2389.38	0.88	6.11	95.79	1208.5	96627.9
3	11:31:30	11:34:30	1920	0.015	2361.27	1.10	7.57	94.33	1485.5	98363.7
4	11:35:15	11:37:00	1590	0.013	2388.00	0.89	6.18	95.72	1222.2	97723.2
5	11:37:00	11:40:30	1200	0.009	2427.18	0.60	4.15	97.75	829.3	87855.1

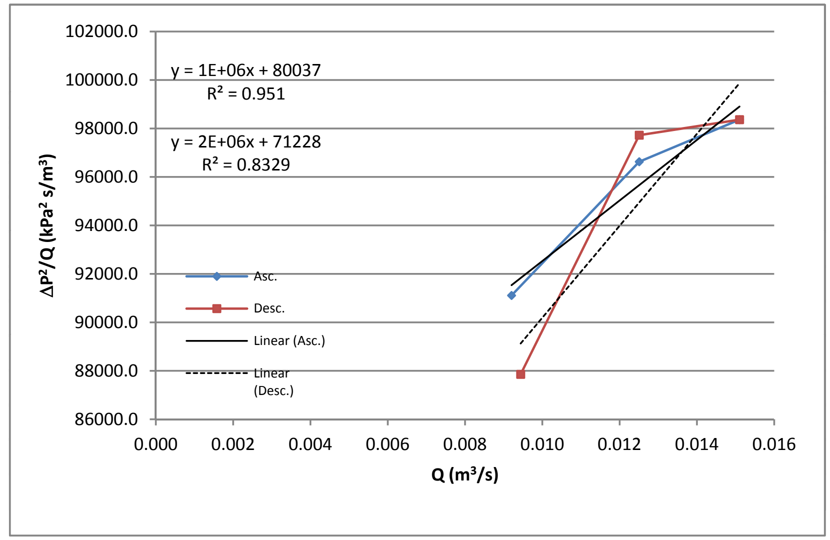
Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.









Q/P (m^3/s kPa)
2.19E-03
2.05E-03
1.99E-03
2.02E-03
2.27E-03

Packer Test:	**160909-A-Ang-2**
Client:	Syncrude Canada Ltd.

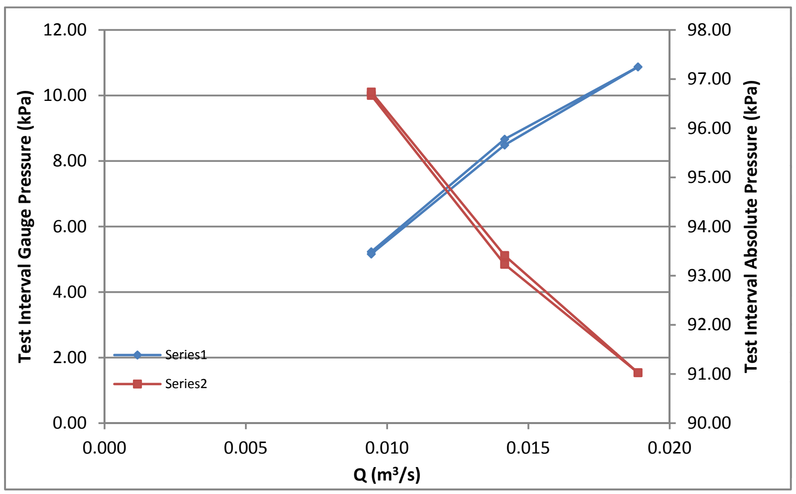
Test Date	16-Sep-09
Beginning Time	11:46:00
Ending Time	12:21:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	3.64
Test Interval Temperature	8.4
Ambient Barometric Pressure (kPa)	101.9

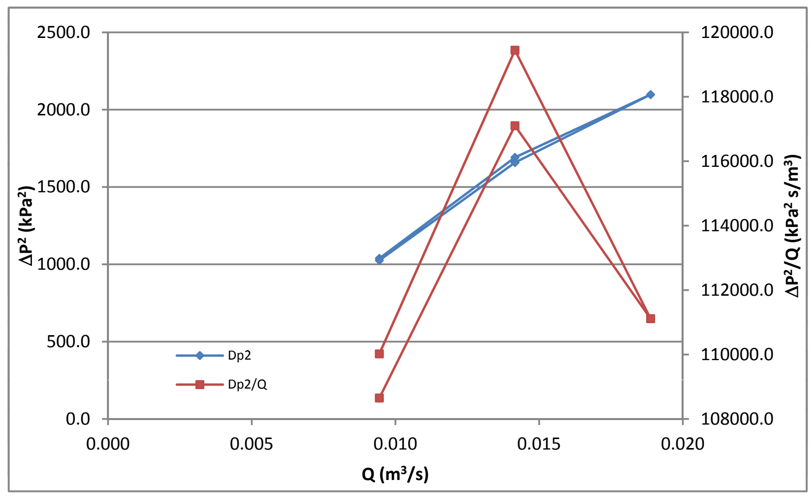
Measurement	**Depth** (m)
Top of Upper Packer	2.29
Top of Test Interval	3.15
Bottom of Test Interval	4.13
Bottom of Lower Packer	4.99

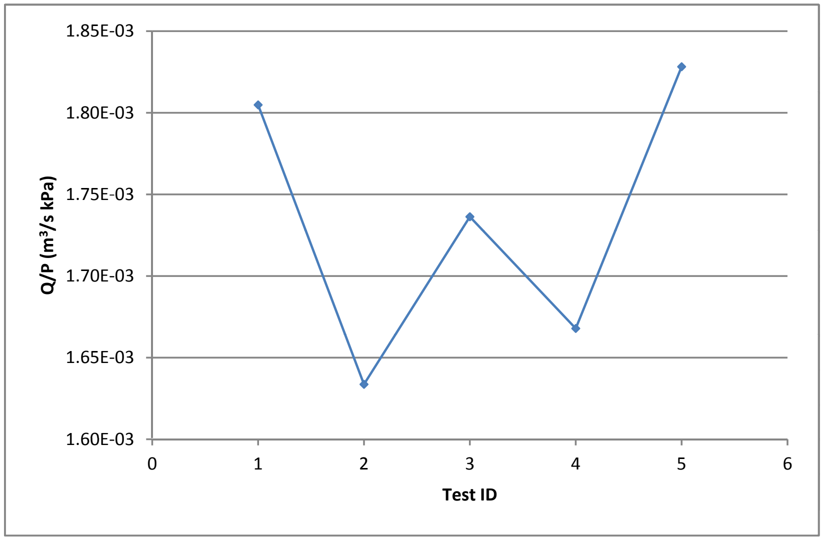
Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2 s/m^3$)
1	11:54:45	12:00:00	1200	0.009	2406.42	0.76	5.23	96.67	1038.5	110021.2
2	12:00:00	12:04:45	1800	0.014	2340.12	1.25	8.67	93.23	1691.2	119445.6
3	12:04:45	12:10:00	2400	0.019	2297.57	1.57	10.87	91.03	2097.6	111113.5
4	12:14:15	12:17:30	1800	0.014	2343.55	1.23	8.49	93.41	1658.0	117101.6
5	12:17:30	12:21:00	1200	0.009	2407.71	0.75	5.16	96.74	1025.6	108651.0

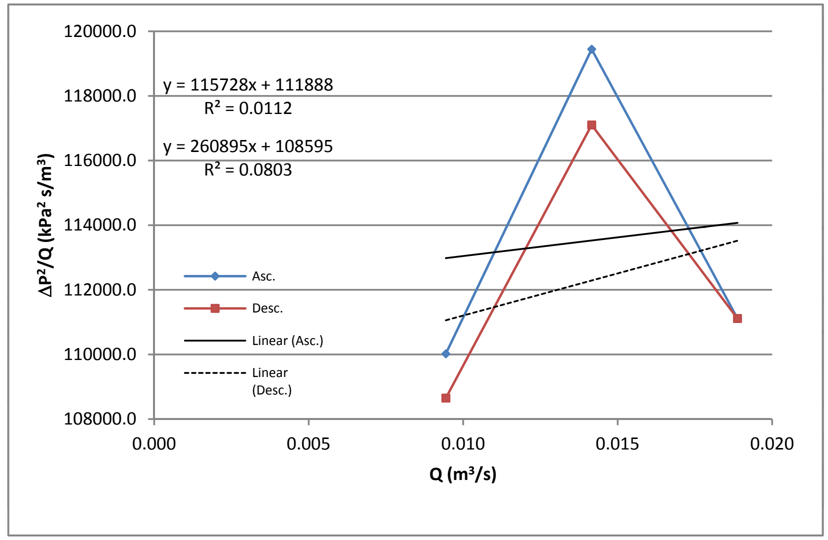
Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.









Q/P (m^3/s kPa)
1.80E-03
1.63E-03
1.74E-03
1.67E-03
1.83E-03

Packer Test:	**160909-A-Ang-3**
Client:	Syncrude Canada Ltd.

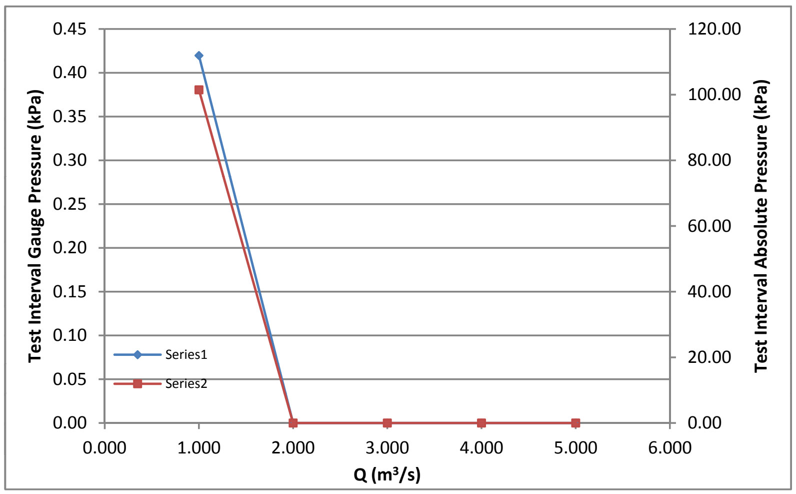
Test Date	16-Sep-09
Beginning Time	14:15:00
Ending Time	14:23:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	5.34
Test Interval Temperature	8.6
Ambient Barometric Pressure (kPa)	101.9

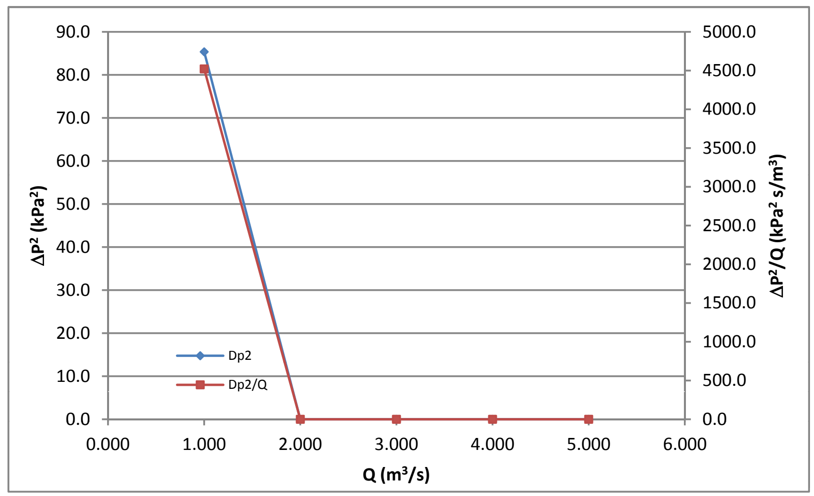
Measurement	**Depth** (m)
Top of Upper Packer	3.99
Top of Test Interval	4.85
Bottom of Test Interval	5.83
Bottom of Lower Packer	6.69

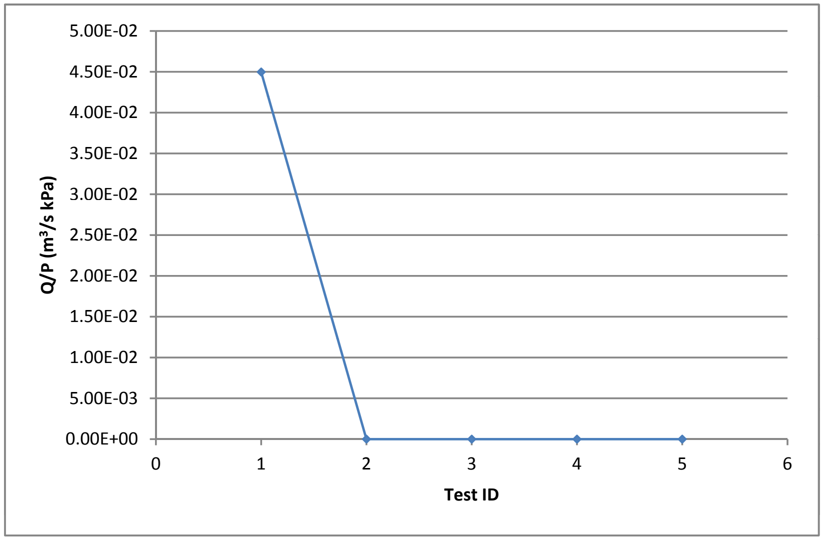
Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2 s/m^3$)
1	14:20:00	14:23:00	2400	0.019	2499.21	0.06	0.42	101.48	85.4	4521.9
2	---	---	---	---	---	---	---	---	---	---
3	---	---	---	---	---	---	---	---	---	---
4	---	---	---	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---	---	---	---

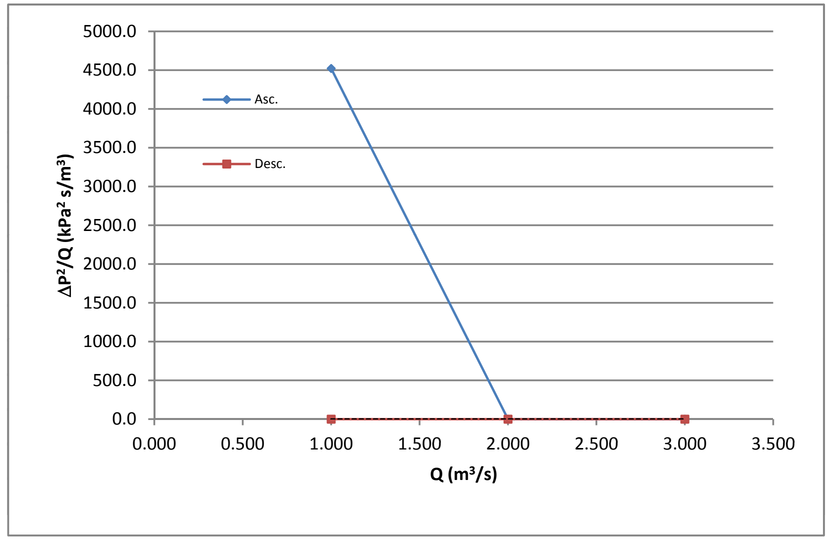
Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.









Q/P (m^3/s kPa)
4.50E-02

Packer Test:	**160909-A-Ang-4**
Client:	Syncrude Canada Ltd.

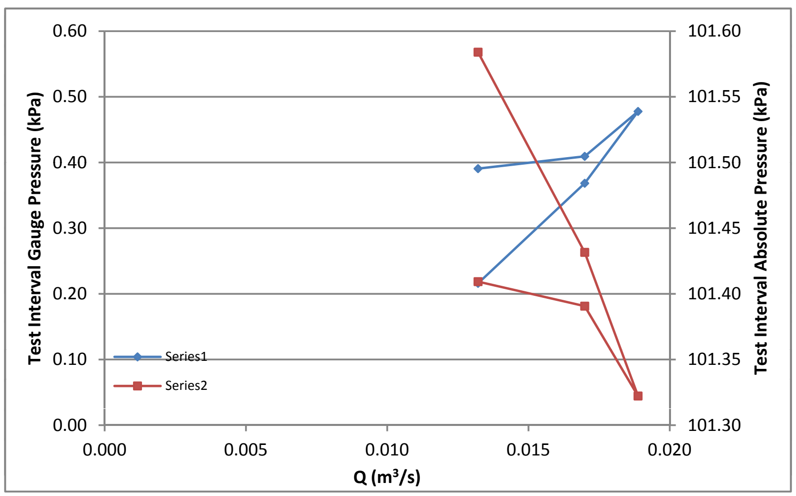
Test Date	16-Sep-09
Beginning Time	14:30:00
Ending Time	15:06:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	6.05
Test Interval Temperature	8.6
Ambient Barometric Pressure (kPa)	101.8

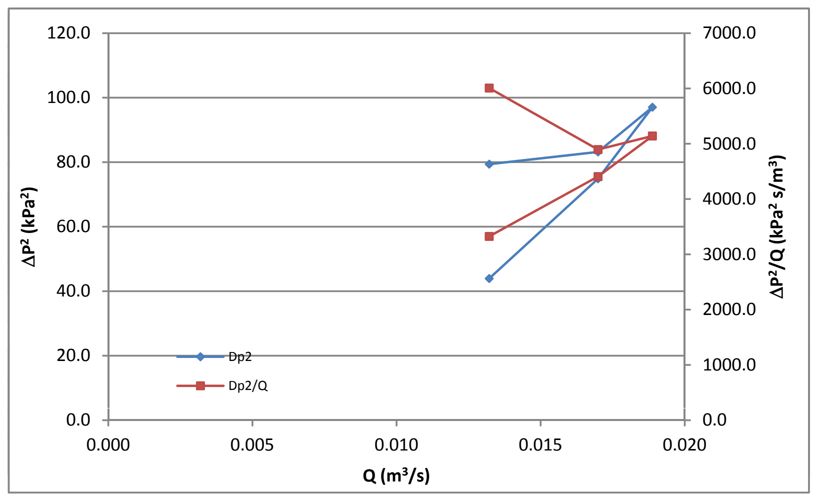
Measurement	**Depth** (m)
Top of Upper Packer	4.70
Top of Test Interval	5.56
Bottom of Test Interval	6.53
Bottom of Lower Packer	7.39

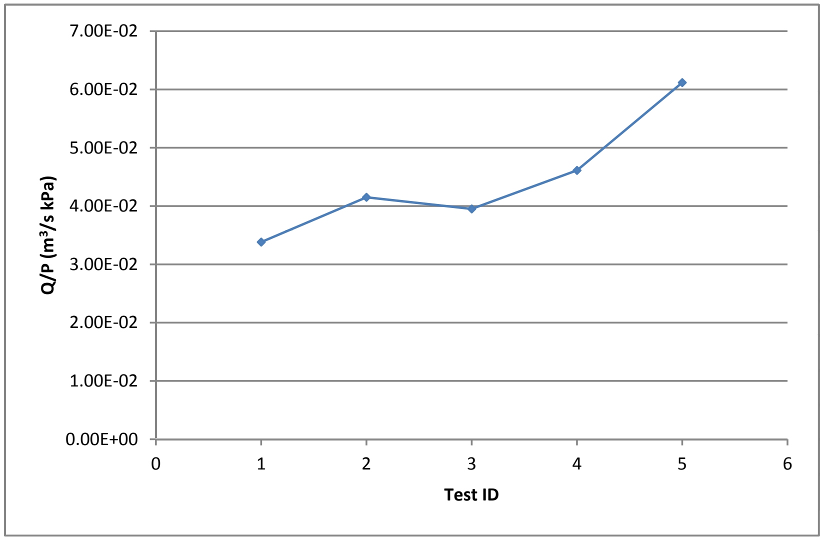
Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\ s/m^3$)
1	14:33:30	14:44:30	1680	0.013	2499.77	0.06	0.39	101.41	79.4	6008.0
2	14:44:30	14:59:15	2160	0.017	2499.41	0.06	0.41	101.39	83.2	4895.6
3	14:59:15	15:02:00	2400	0.019	2498.09	0.07	0.48	101.32	97.0	5140.8
4	15:02:00	15:03:15	2160	0.017	2500.20	0.05	0.37	101.43	74.9	4406.7
5	15:03:15	15:06:45	1680	0.013	2503.14	0.03	0.22	101.58	43.9	3324.4

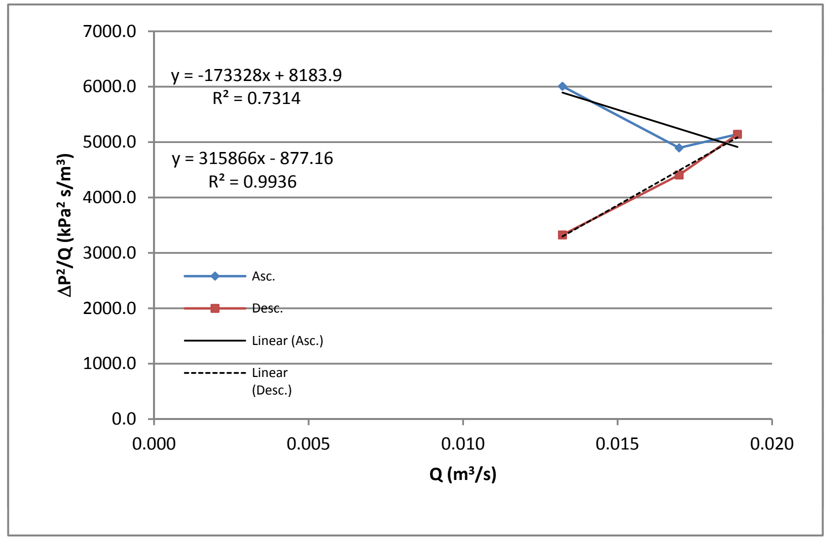
Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.









Q/P (m^3/s kPa)
3.38E-02
4.15E-02
3.95E-02
4.61E-02
6.12E-02

Packer Test:	**160909-A-Ang-5**
Client:	Syncrude Canada Ltd.

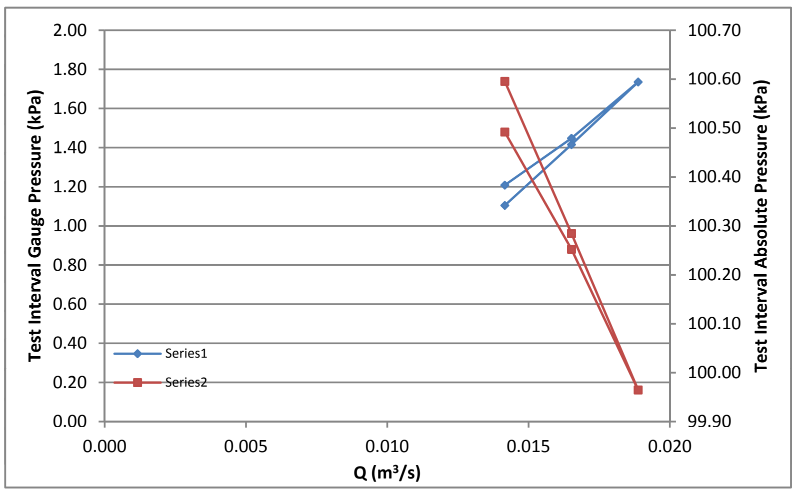
Test Date	16-Sep-09
Beginning Time	15:11:00
Ending Time	15:27:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	7.02
Test Interval Temperature	8.9
Ambient Barometric Pressure (kPa)	101.7

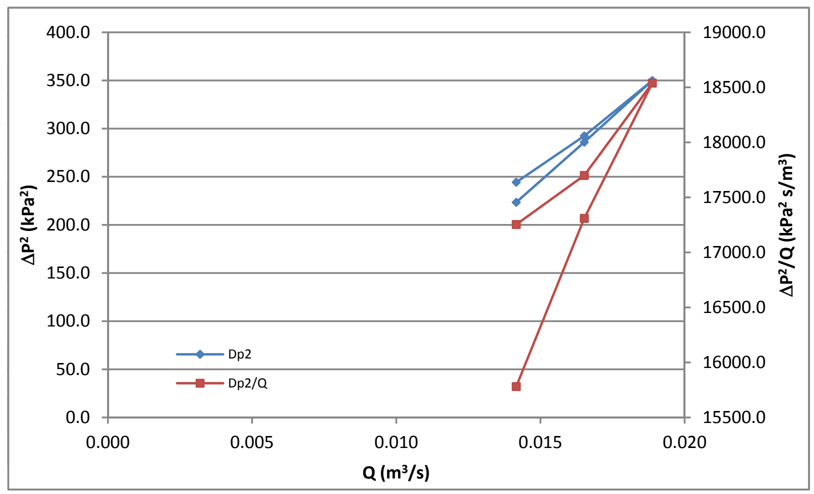
Measurement	**Depth** (m)
Top of Upper Packer	5.67
Top of Test Interval	6.53
Bottom of Test Interval	7.51
Bottom of Lower Packer	8.37

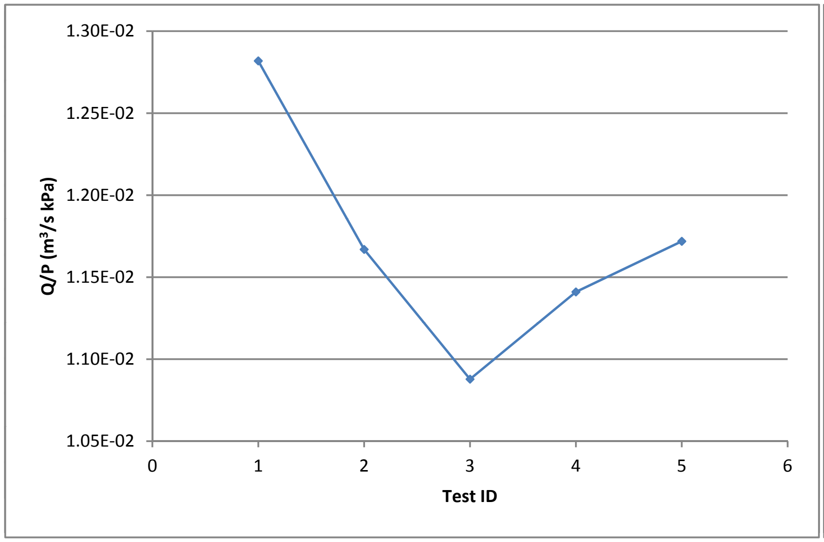
Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\,s/m^3$)
1	15:18:30	15:21:00	1800	0.014	2486.00	0.16	1.10	100.60	223.4	15781.2
2	15:21:00	15:22:30	2100	0.017	2480.00	0.20	1.42	100.28	285.9	17309.2
3	15:22:30	15:24:00	2400	0.019	2473.83	0.25	1.74	99.96	350.0	18538.4
4	15:24:00	15:26:00	2100	0.017	2479.38	0.21	1.45	100.25	292.4	17699.4
5	15:26:00	15:27:30	1800	0.014	2484.00	0.17	1.21	100.49	244.3	17253.7

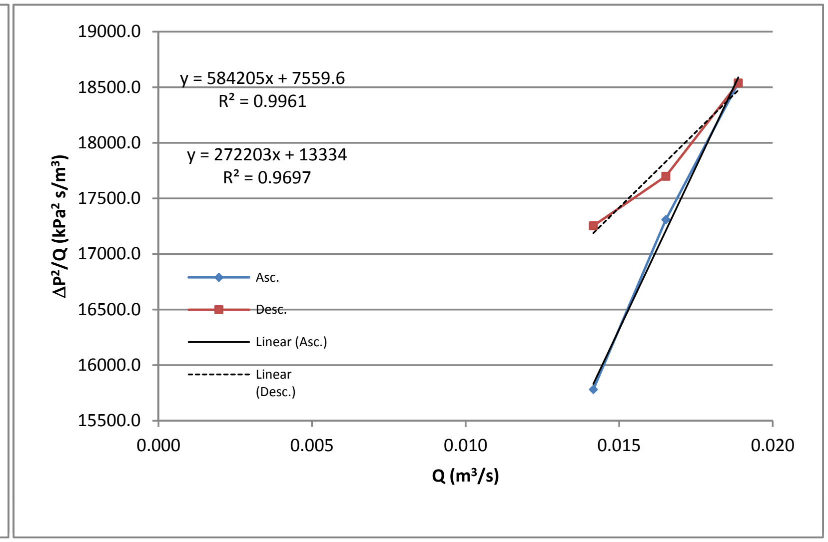
Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.









Q/P (m^3/s kPa)
1.28E-02
1.17E-02
1.09E-02
1.14E-02
1.17E-02

Packer Test:	**160909-A-ang-6**
Client:	Syncrude Canada Ltd.

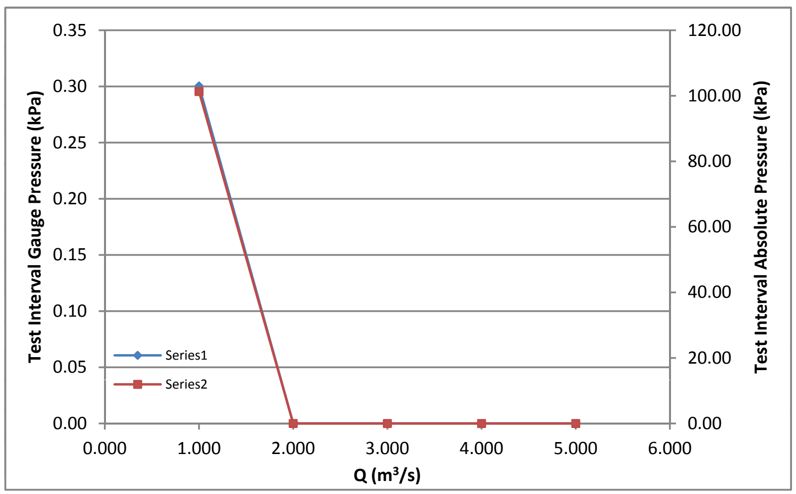
Test Date	16-Sep-09
Beginning Time	16:25:00
Ending Time	16:28:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	8
Test Interval Temperature	9.1
Ambient Barometric Pressure (kPa)	101.6

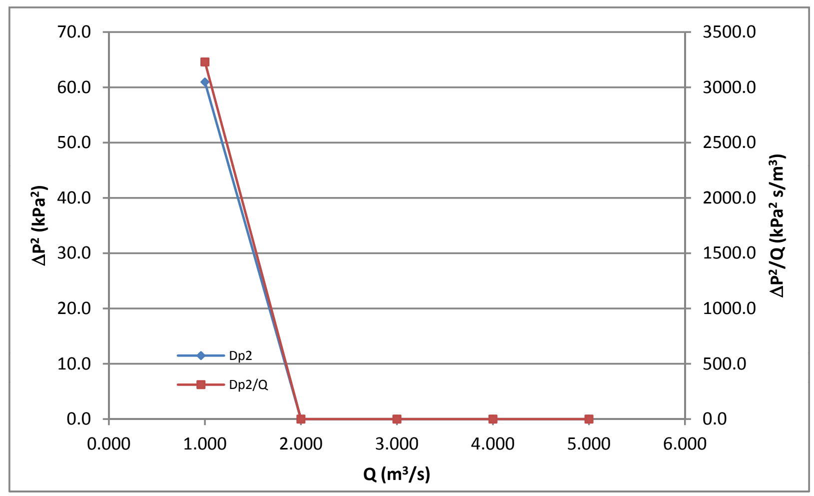
Measurement	**Depth** (m)
Top of Upper Packer	6.65
Top of Test Interval	7.51
Bottom of Test Interval	8.49
Bottom of Lower Packer	9.35

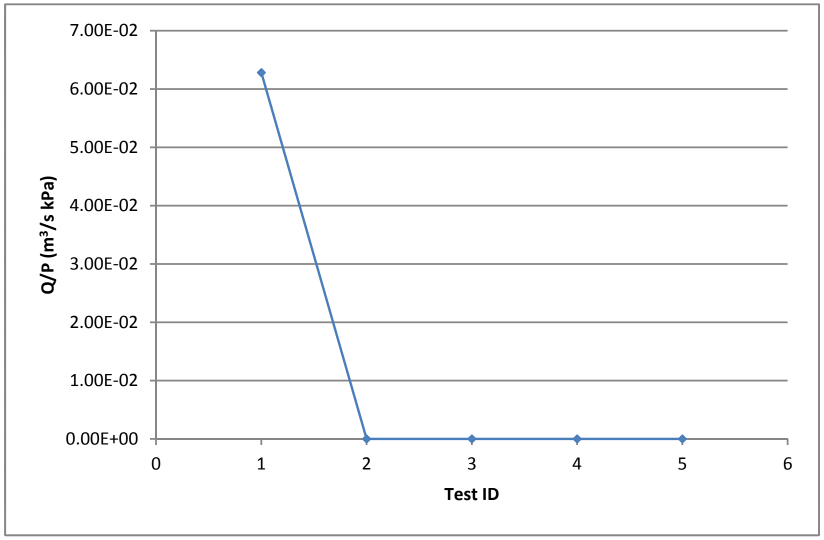
Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2 s/m^3$)
1	16:25:00	16:28:00	2400	0.019	2501.51	0.04	0.30	101.30	61.0	3229.7
2	---	---	---	---	---	---	---	---	---	---
3	---	---	---	---	---	---	---	---	---	---
4	---	---	---	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---	---	---	---

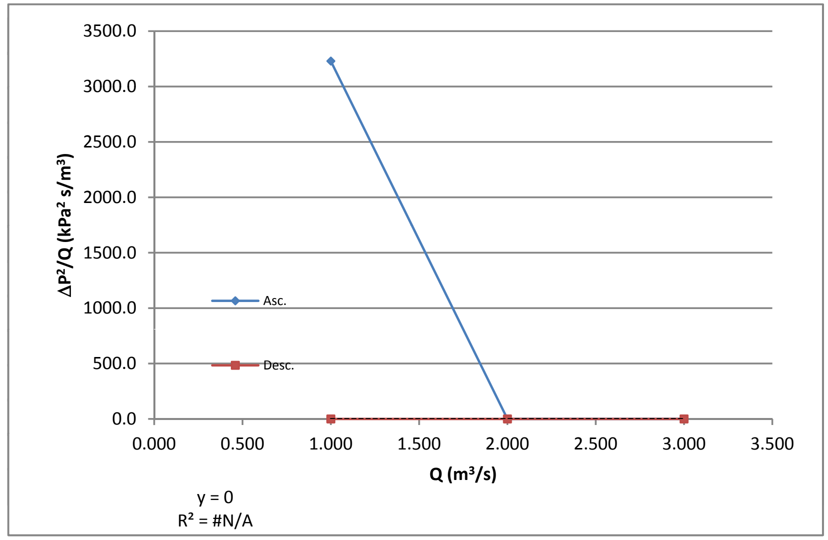
Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.









Q/P (m^3/s kPa)
6.28E-02

Packer Test: **160909-A-Ang-7**

Client: Syncrude Canada Ltd.

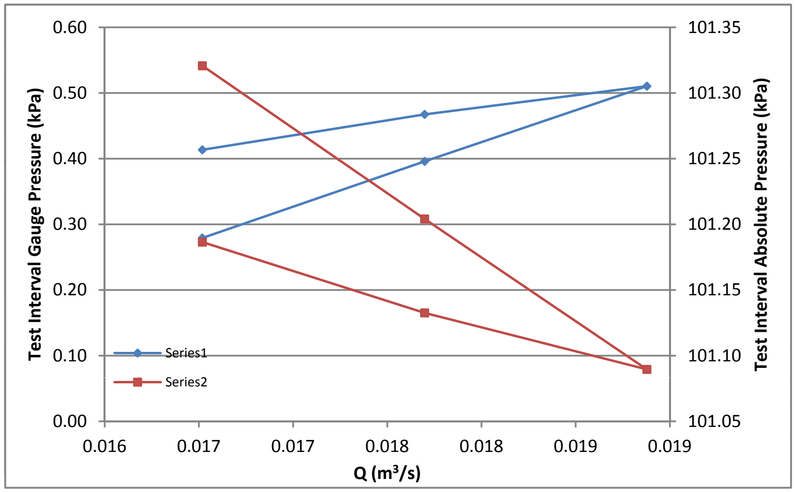
Test Date	16-Sep-09
Beginning Time	16:34:00
Ending Time	16:48:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	8.97
Test Interval Temperature	9.6
Ambient Barometric Pressure (kPa)	101.6

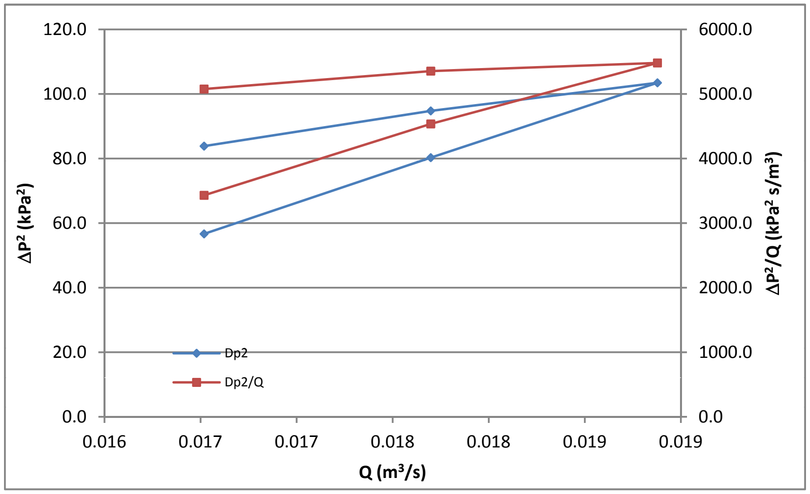
Measurement	**Depth** (m)
Top of Upper Packer	7.63
Top of Test Interval	8.49
Bottom of Test Interval	9.46
Bottom of Lower Packer	10.32

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\,s/m^3$)
1	16:37:15	16:38:45	2100	0.017	2499.33	0.06	0.41	101.19	83.9	5076.4
2	16:38:45	16:40:30	2250	0.018	2498.29	0.07	0.47	101.13	94.8	5354.3
3	16:40:30	16:43:45	2400	0.019	2497.46	0.07	0.51	101.09	103.5	5480.5
4	16:43:45	16:45:15	2250	0.018	2499.67	0.06	0.40	101.20	80.3	4536.4
5	16:45:15	16:48:30	2100	0.017	2501.92	0.04	0.28	101.32	56.7	3430.4

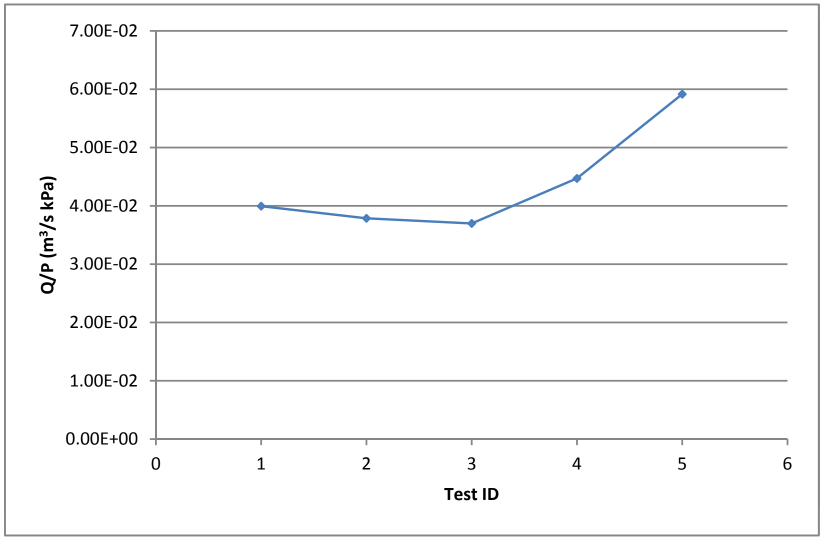
Notes:

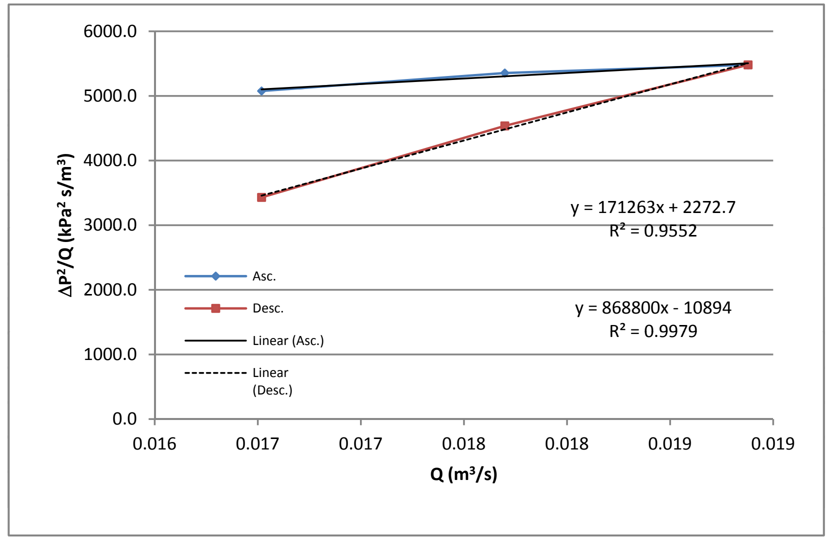
For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.





195





Q/P (m^3/s kPa)
3.99E-02
3.79E-02
3.70E-02
4.47E-02
5.92E-02

Packer Test: **160909-A-Ang-8**

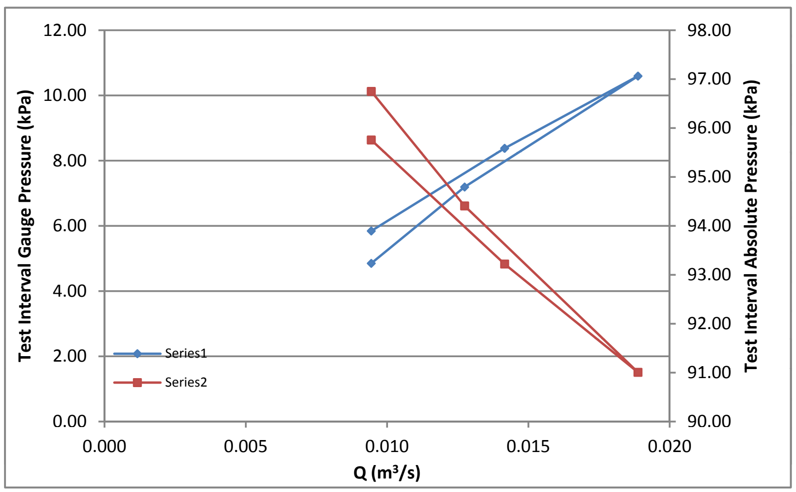
Client:	Syncrude Canada Ltd.
Test Date	16-Sep-09
Beginning Time	17:30:00
Ending Time	17:56:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	9.95
Test Interval Temperature	9.1
Ambient Barometric Pressure (kPa)	101.6

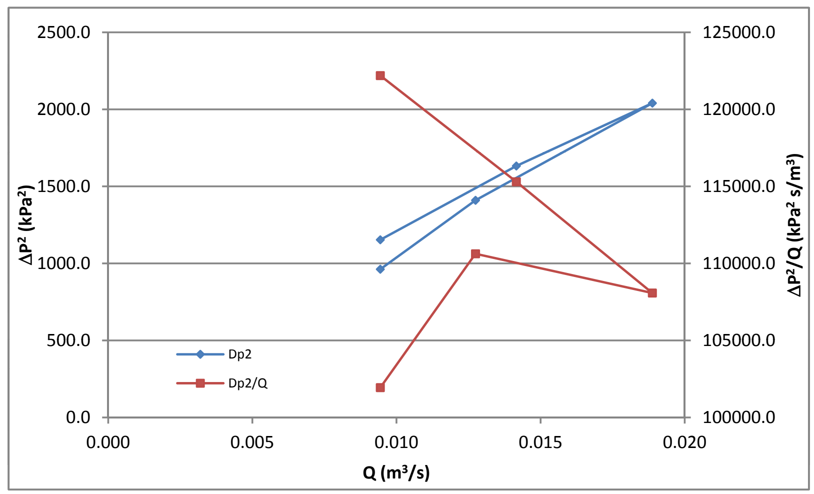
Measurement	**Depth** (m)
Top of Upper Packer	8.60
Top of Test Interval	9.46
Bottom of Test Interval	10.44
Bottom of Lower Packer	11.30

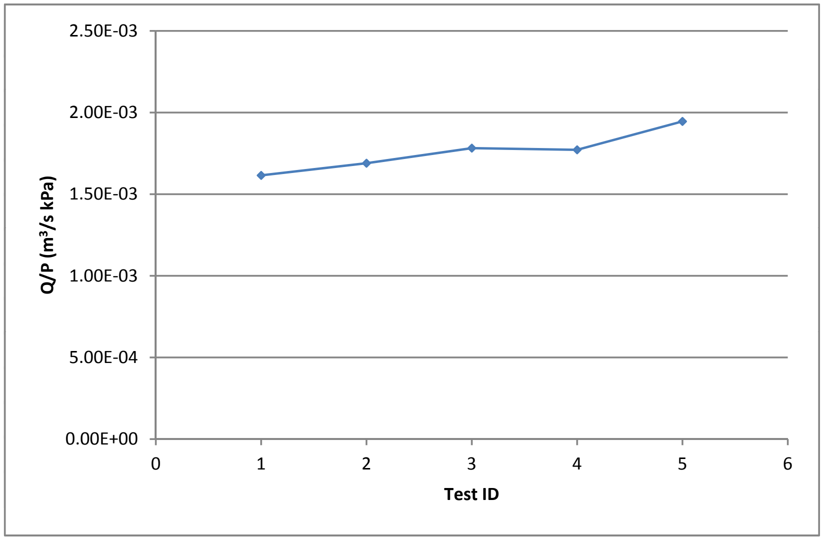
Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\, s/m^3$)
1	17:30:45	17:34:15	1200	0.009	2394.57	0.85	5.84	95.76	1153.4	122190.8
2	17:43:45	17:45:15	1800	0.014	2345.67	1.21	8.38	93.22	1632.4	115297.9
3	17:45:15	17:51:15	2400	0.019	2302.96	1.53	10.59	91.01	2040.3	108079.0
4	17:51:15	17:53:15	1620	0.013	2368.57	1.04	7.19	94.41	1409.7	110625.6
5	17:53:15	17:56:00	1200	0.009	2413.73	0.70	4.85	96.75	962.2	101938.6

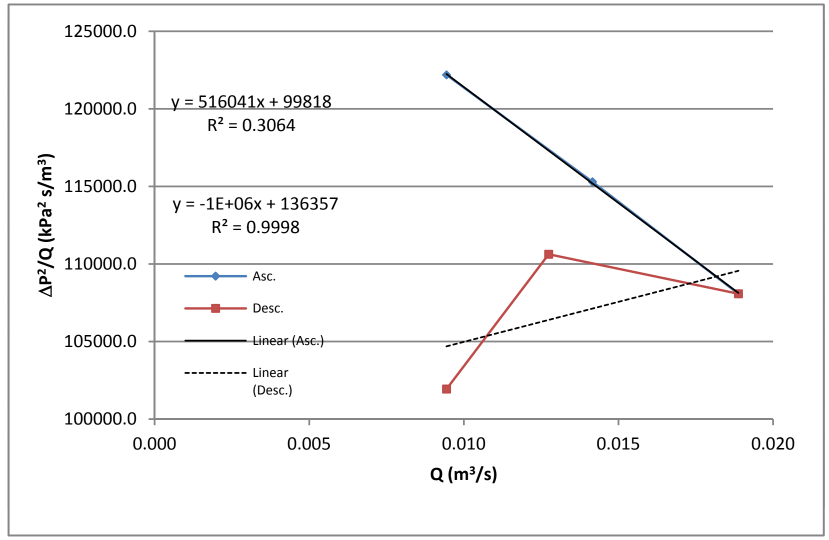
Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.









Q/P (m^3/s kPa)
1.62E-03
1.69E-03
1.78E-03
1.77E-03
1.95E-03

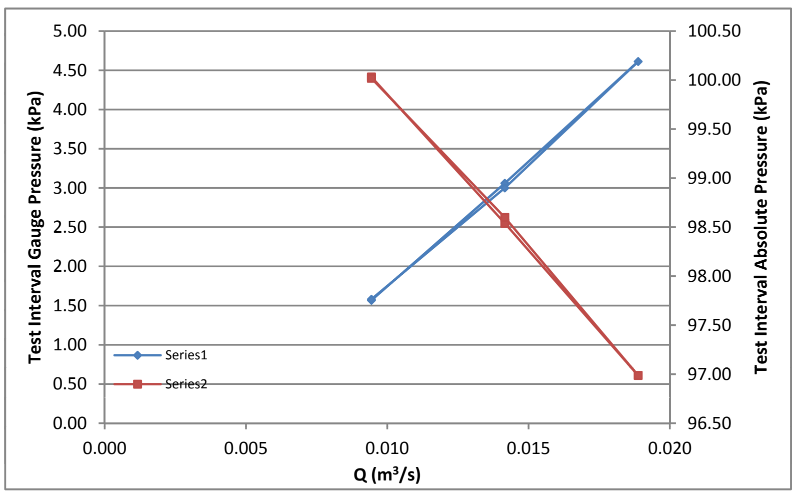
Packer Test:	**160909-A-Ang-9**
Client:	Syncrude Canada Ltd.
Test Date	16-Sep-09
Beginning Time	18:00:00
Ending Time	18:09:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	10.92
Test Interval Temperature	9.6
Ambient Barometric Pressure (kPa)	101.6

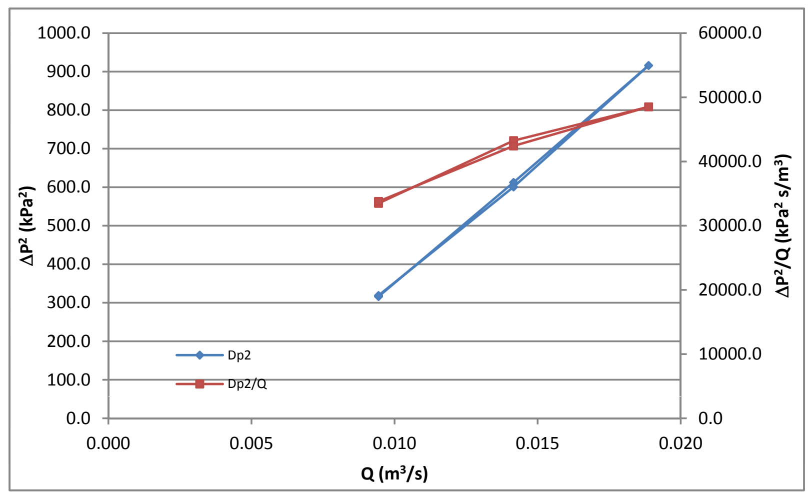
Measurement	**Depth** (m)
Top of Upper Packer	9.58
Top of Test Interval	10.44
Bottom of Test Interval	11.41
Bottom of Lower Packer	12.27

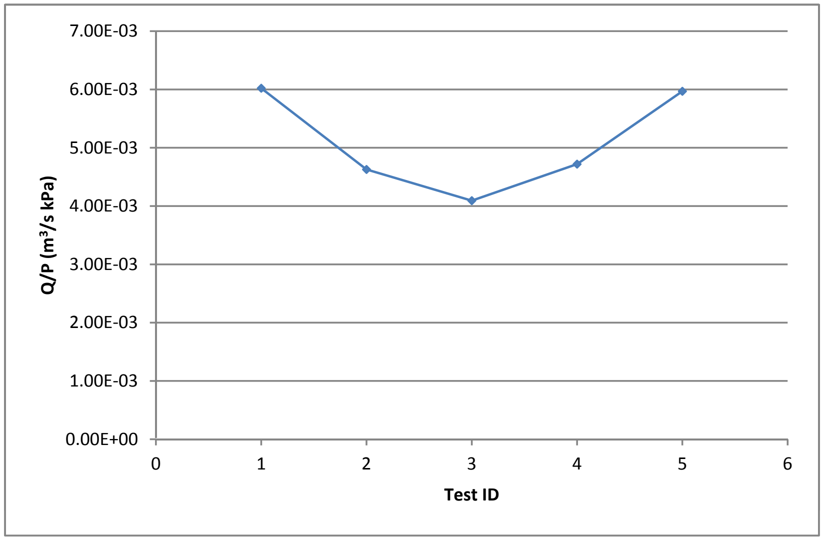
Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\ s/m^3$)
1	18:03:45	18:07:30	1200	0.009	2477.07	0.23	1.57	100.03	316.1	33486.6
2	18:07:30	18:09:30	1800	0.014	2448.29	0.44	3.06	98.54	612.3	43249.2
3	18:09:30	18:13:15	2400	0.019	2418.33	0.67	4.61	96.99	915.9	48518.9
4	18:13:15	18:15:15	1800	0.014	2449.43	0.43	3.00	98.60	600.7	42424.3
5	18:15:15	18:19:00	1200	0.009	2476.80	0.23	1.58	100.02	318.8	33779.6

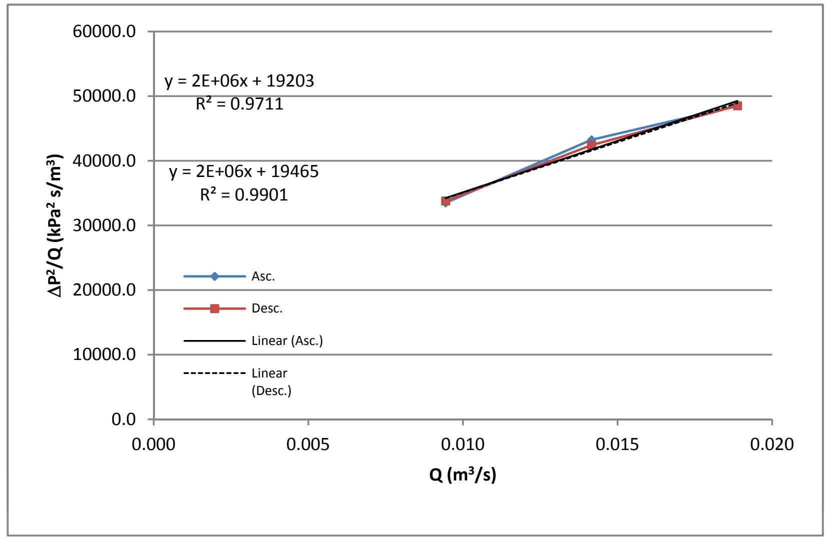
Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.









Q/P (m^3/s kPa)
6.02E-03
4.63E-03
4.09E-03
4.72E-03
5.97E-03

Packer Test:	**160909-A-Ang-10**
Client:	Syncrude Canada Ltd.

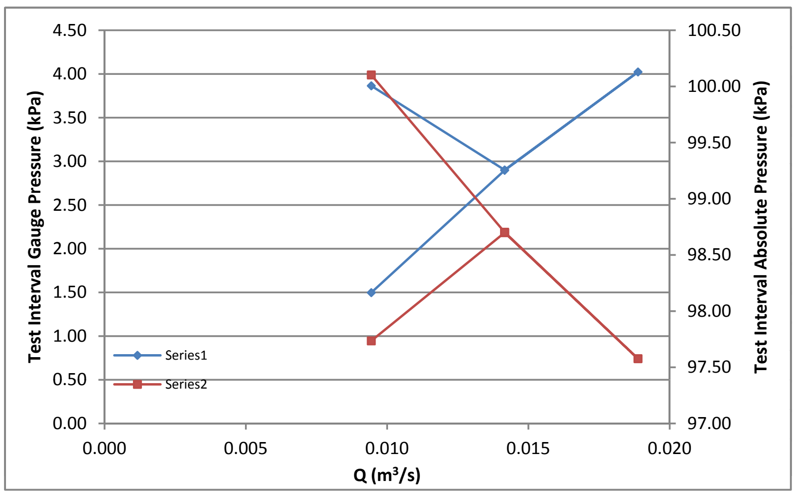
Test Date	16-Sep-09
Beginning Time	18:24:00
Ending Time	18:43:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	11.31
Test Interval Temperature	9.6
Ambient Barometric Pressure (kPa)	101.6

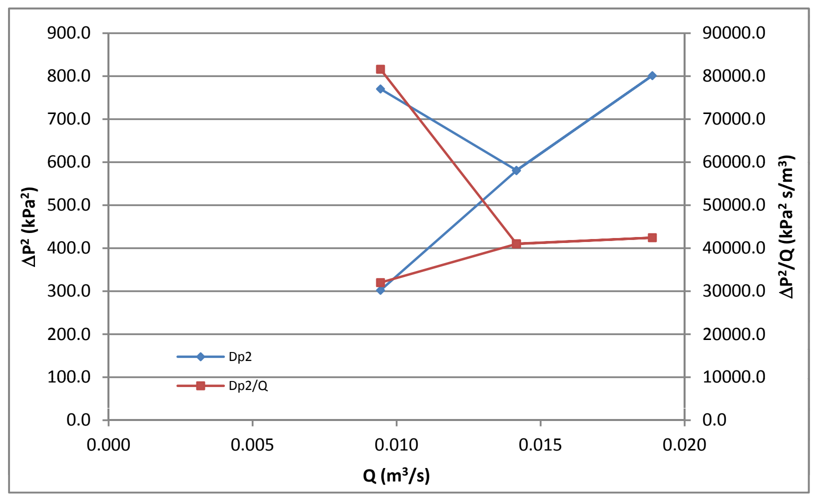
Measurement	**Depth** (m)
Top of Upper Packer	9.97
Top of Test Interval	10.83
Bottom of Test Interval	11.80
Bottom of Lower Packer	12.66

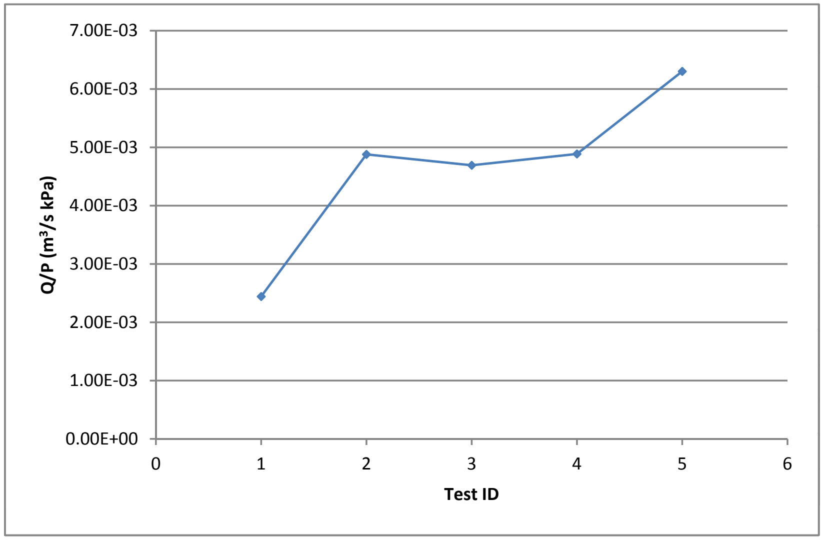
Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\,s/m^3$)
1	18:24:15	18:32:45	1200	0.009	2432.76	0.56	3.86	97.74	770.3	81612.3
2	18:32:45	18:34:15	1800	0.014	2451.33	0.42	2.90	98.70	581.2	41048.4
3	18:34:15	18:36:45	2400	0.019	2429.70	0.58	4.02	97.58	801.3	42446.0
4	18:36:45	18:40:00	1800	0.014	2451.42	0.42	2.90	98.70	580.3	40988.2
5	18:40:00	18:43:00	1200	0.009	2478.42	0.22	1.50	100.10	302.1	32002.8

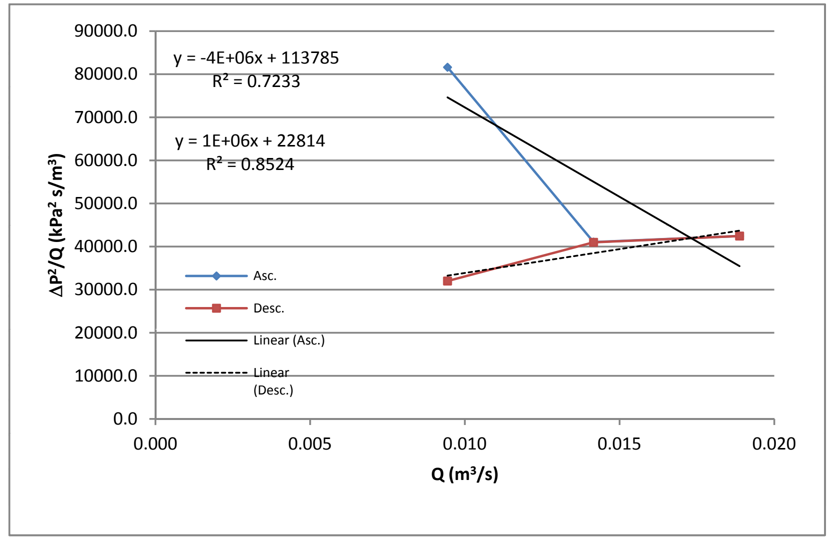
Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.







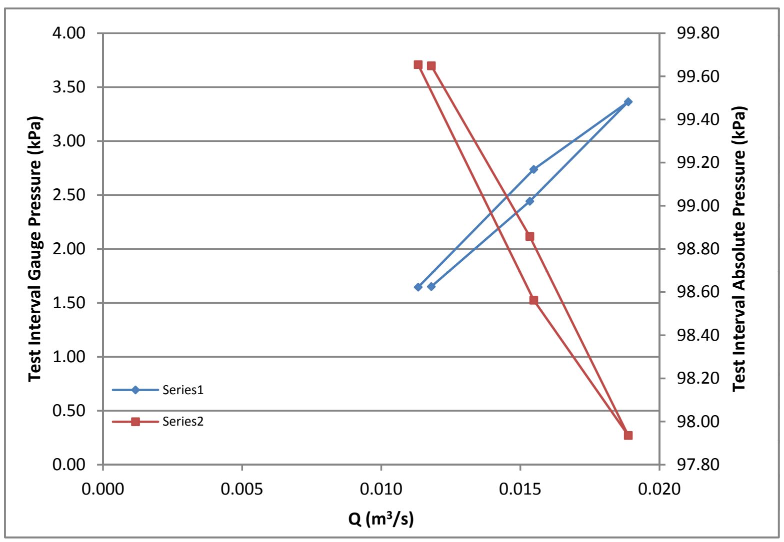


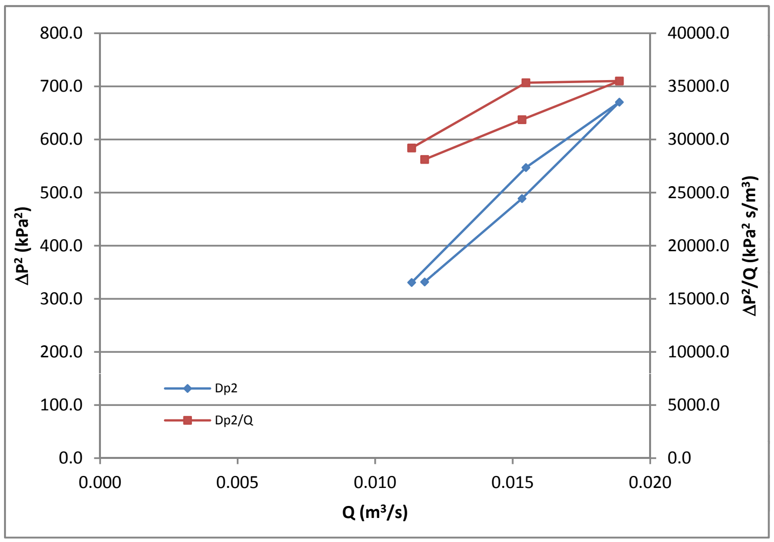
Q/P (m^3/s kPa)
2.44E-03
4.88E-03
4.69E-03
4.89E-03
6.30E-03

Packer Test:	230909-B-VERT-1
Client:	Syncrude Canada Ltd.
Test Date	Sept 23/09
Beginning Time	10:13:15
Ending Time	11:02:30
Test Interval Length (m)	1.38
Center of Test Interval (m)	1.87
Test Interval Temperature	12.9
Ambient Barometric Pressure (kPa	101.3

Measurement	Depth (m)
Top of Upper Packer	0.32
Top of Test Interval	1.18
Bottom of Test Interval	2.56
Bottom of Lower Packer	3.42

Flow Rate ID	Begin Time (HH:MM:SS)	Ending Time (HH:MM:SS)	Pump Rate (ft^3/hr)	Pump Rate (m^3/s)	Transducer Output (mV)	Gauge Pressure (psi)	Gauge Pressure (kPa)	Absolute Pressure (kPa)	ΔP^2 (kPa^2)	$\Delta P^2/Q$ ($kPa^2\ s/m^3$)
1	10:18:30	10:27:30	1440	0.011	2475.56	0.24	1.65	99.65	330.8	29201.4
2	10:27:30	10:32:30	1968	0.015	2454.50	0.40	2.74	98.56	547.1	35343.1
3	10:32:30	10:41:45	2400	0.019	2442.41	0.49	3.36	97.94	670.3	35507.4
4	10:41:45	10:52:00	1950	0.015	2460.20	0.35	2.44	98.86	488.8	31866.3
5	10:52:00	11:00:30	1500	0.012	2475.46	0.24	1.65	99.65	331.8	28119.5





Packer Test: **230909-B-VERT-1**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 131	*Initial Reading*	*-0.25*	*-1.00*	*-0.50*	*-0.25*	*-0.75*	*-0.50*	*-0.50*
	1	1.50	0.50	-0.50	0.00	-0.75	-0.50	-0.50
	2	2.00	0.75	0.25	0.00	-0.75	-0.50	-0.50
	3	2.00	1.00	0.25	0.00	-0.50	-0.50	-0.50
	4	1.75	0.75	0.00	0.00	-0.50	-0.50	-0.25
	5	1.50	0.50	-0.25	0.00	-0.50	-0.50	-0.50

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 130	*Initial Reading*	*-0.75*	*-0.75*	*-1.50*	*-0.50*	*-0.50*	*-0.25*
	1	-0.75	-0.75	-1.50	-0.50	-0.50	0.00
	2	0.00	0.00	0.00	0.00	0.00	0.00
	3	-0.50	-0.50	-0.75	-0.50	0.25	0.25
	4	-0.25	-0.25	-0.50	0.00	0.25	0.50
	5	-0.75	-0.75	-1.25	-0.75	-0.25	-0.25

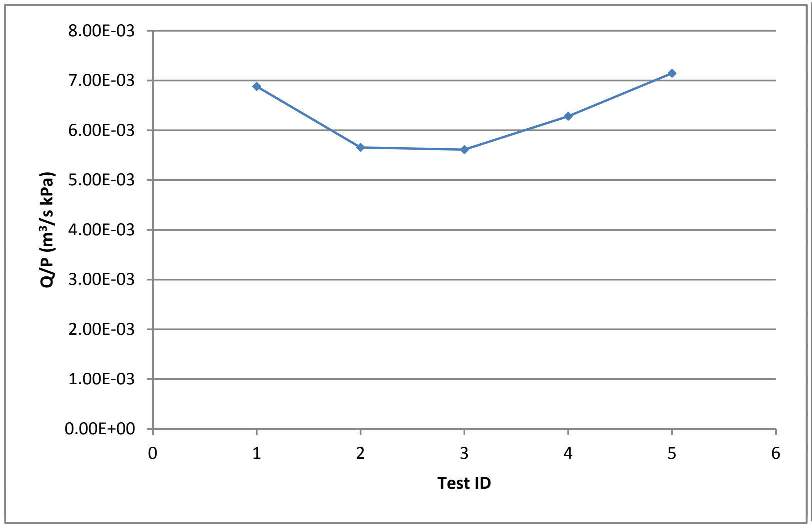
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 129	*Initial Reading*	*-1.00*	*-0.50*	*-1.50*	*-0.50*	*-0.75*	*-0.75*	*-0.25*
	1	-1.00	-0.50	-1.50	-0.50	-1.00	-0.75	-0.25
	2	---	---	---	---	---	---	---
	3	-1.00	-0.50	-1.50	-0.50	-1.00	-0.75	-0.25
	4	---	---	---	---	---	---	---
	5	-1.00	-0.50	-1.50	-0.50	-1.00	-0.75	-0.25

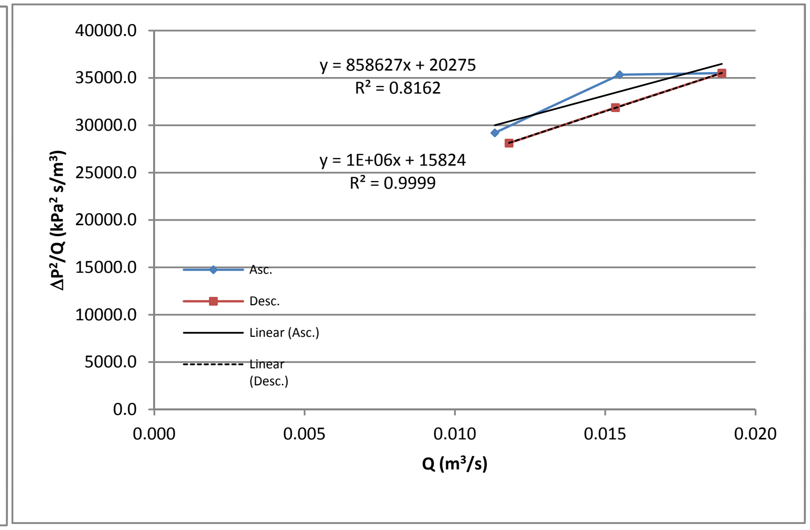
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 131	1	1.75	1.50	0.00	0.25	0.00	0.00	0.00
	2	2.25	1.75	0.75	0.25	0.00	0.00	0.00
	3	2.25	2.00	0.75	0.25	0.25	0.00	0.00
	4	2.00	1.75	0.50	0.25	0.25	0.00	0.25
	5	1.75	1.50	0.25	0.25	0.25	0.00	0.00

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 130	1	0.00	0.00	0.00	0.00	0.00	0.25
	2	0.75	0.75	1.50	0.50	0.50	0.25
	3	0.25	0.25	0.75	0.00	0.75	0.50
	4	0.50	0.50	1.00	0.50	0.75	0.75
	5	0.00	0.00	0.25	-0.25	0.25	0.00

		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 129	1	0.00	0.00	0.00	0.00	-0.25	0.00	0.00
	2	---	---	---	---	---	---	---
	3	0.00	0.00	0.00	0.00	-0.25	0.00	0.00
	4	---	---	---	---	---	---	---
	5	0.00	0.00	0.00	0.00	-0.25	0.00	0.00



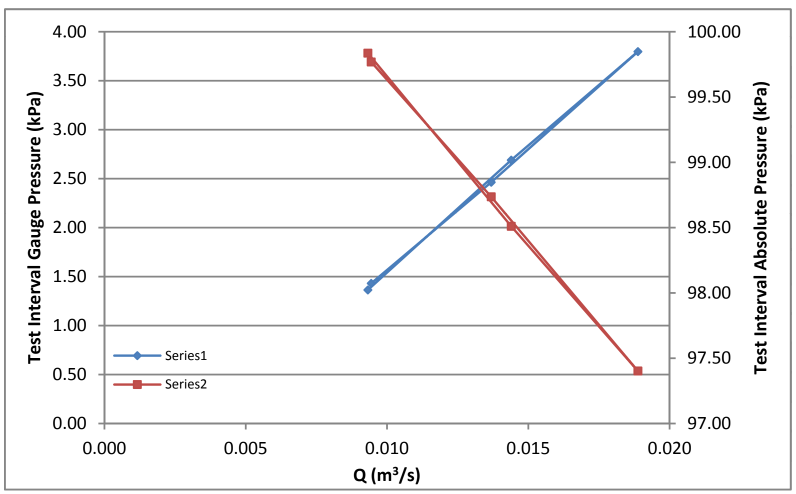


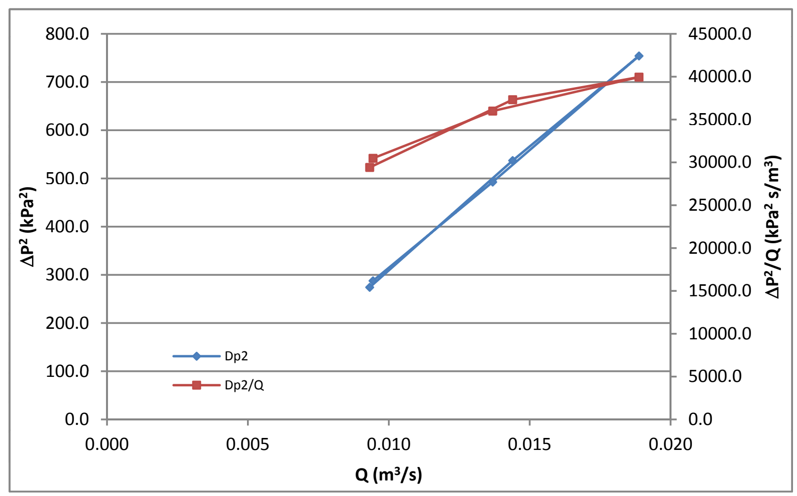
Q/P (m^3/s kPa)
6.88E-03
5.65E-03
5.61E-03
6.28E-03
7.15E-03

Packer Test:	**230909-B-VERT-2**
Client:	Syncrude Canada Ltd.
Test Date	Sept 23/09
Beginning Time	11:08:00
Ending Time	11:49:30
Test Interval Length (m)	1.38
Center of Test Interval (m)	3.25
Test Interval Temperature	8.9
Ambient Barometric Pressure (kPa)	101.2

Measurement	**Depth** (m)
Top of Upper Packer	1.70
Top of Test Interval	2.56
Bottom of Test Interv	3.94
Bottom of Lower Pacl	4.80

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\ s/m^3$)
1	11:13:00	11:21:45	1185	0.009	2481.00	0.20	1.36	99.84	274.2	29412.6
2	11:21:45	11:28:15	1830	0.014	2455.42	0.39	2.69	98.51	537.1	37315.5
3	11:28:15	11:37:45	2400	0.019	2434.05	0.55	3.80	97.40	754.2	39949.8
4	11:37:45	11:43:45	1740	0.014	2459.78	0.36	2.46	98.74	492.6	35988.7
5	11:43:34	11:49:30	1200	0.009	2479.70	0.21	1.43	99.77	287.6	30474.8





Packer Test: **230909-B-VERT-2**

Raw Data - Differential Manometer Measurement (mm H_2O)

CMT 131

Measurement ID	1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0	6 [13.0]	7 [15.0]
Initial Reading	*-0.25*	*-1.00*	*-0.50*	*-0.25*	*-0.75*	*-0.50*	*-0.50*
1	0.50	0.50	0.50	0.25	-0.50	-0.25	-0.25
2	0.75	1.25	1.00	0.50	-0.50	-0.25	-0.25
3	1.00	1.50	1.50	0.50	0.00	0.00	-0.25
4	0.50	1.00	1.00	0.50	-0.25	-0.25	-0.25
5	0.25	0.50	0.75	0.25	-0.25	-0.25	-0.25

Gas Port Number [Measurement Depth (m)]

CMT 130

	1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
Initial Reading	*-0.75*	*-0.75*	*-1.50*	*-0.50*	*-0.50*	*-0.25*
1	-0.50	-0.25	-0.50	0.00	0.50	0.25
2	-0.75	-0.75	-1.00	-0.25	-0.25	-0.25
3	-0.50	-0.25	-0.50	0.00	0.25	0.50
4	0.50	-0.50	-1.00	-0.50	-0.25	-0.25
5	-0.25	-0.25	-0.75	0.00	0.00	0.25

CMT 129

	1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0	6 [13.0]	7 [15.0]
Initial Reading	*-1.00*	*-0.50*	*-1.50*	*-0.50*	*-0.75*	*-0.75*	*-0.25*
1	-1.00	-0.50	-1.50	-0.50	-0.75	-0.75	-0.50
2	---	---	---	---	---	---	---
3	-1.00	-0.50	-1.50	-0.50	-0.75	-0.75	-0.50
4	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---

Corrected Data - Net Differential Manometer Measurement (mm H_2O)

Gas Port Number [Measurement Depth (m)]

CMT 131

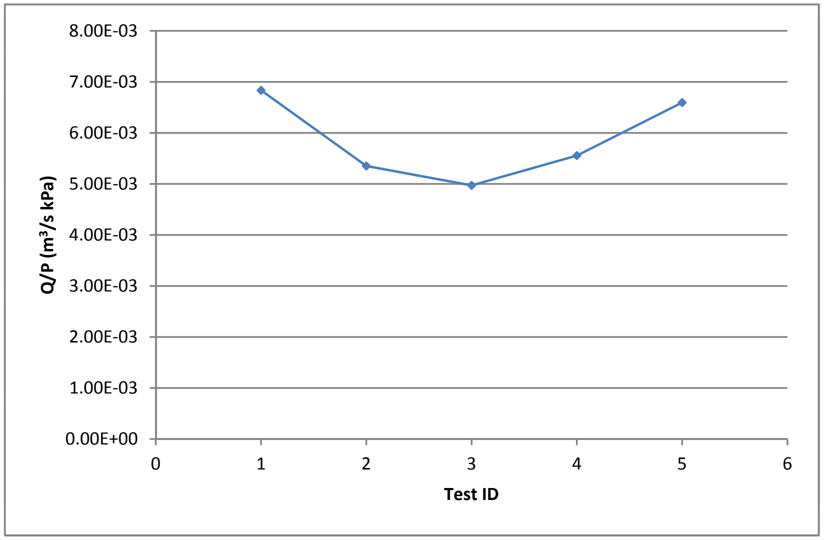
Measurement ID	1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0	6 [13.0]	7 [15.0]
1	0.75	1.50	1.00	0.50	0.25	0.25	0.25
2	1.00	2.25	1.50	0.75	0.25	0.25	0.25
3	1.25	2.50	2.00	0.75	0.75	0.50	0.25
4	0.75	2.00	1.50	0.75	0.50	0.25	0.25
5	0.50	1.50	1.25	0.50	0.50	0.25	0.25

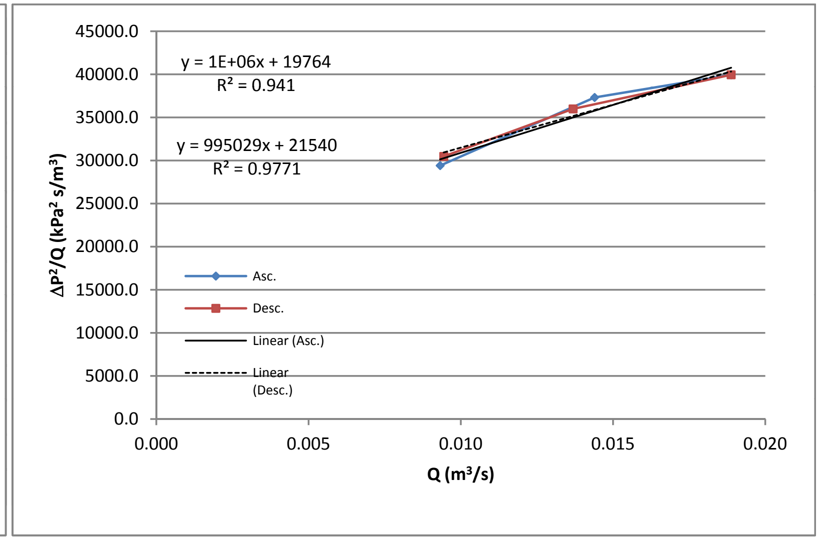
CMT 130

	1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
1	0.25	0.50	1.00	0.50	1.00	0.50
2	0.00	0.00	0.50	0.25	0.25	0.00
3	0.25	0.50	1.00	0.50	0.75	0.75
4	1.25	0.25	0.50	0.00	0.25	0.00
5	0.50	0.50	0.75	0.50	0.50	0.50

CMT 129

	1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0	6 [13.0]	7 [15.0]
1	0.00	0.00	0.00	0.00	0.00	0.00	-0.25
2	---	---	---	---	---	---	---
3	0.00	0.00	0.00	0.00	0.00	0.00	-0.25
4	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---





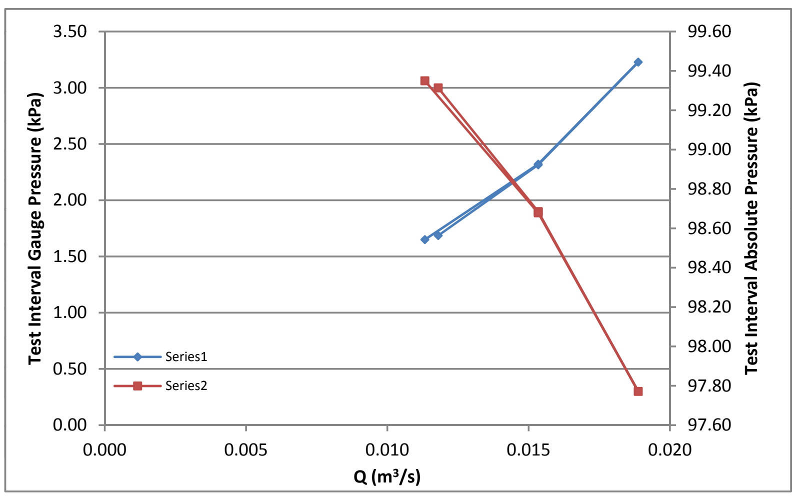
Q/P (m^3/s kPa)
6.84E-03
5.35E-03
4.97E-03
5.56E-03
6.59E-03

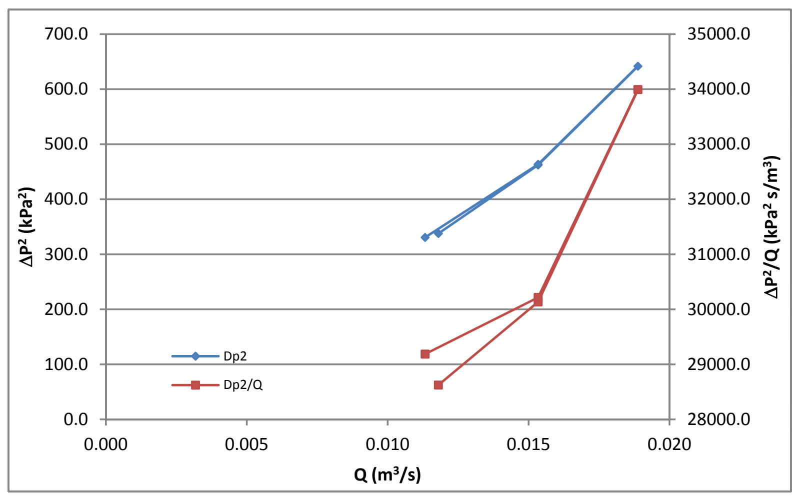
Packer Test:	**230909-B-VERT-3**
Client:	Syncrude Canada Ltd.

Test Date	Sept 23/09
Beginning Time	13:10:00
Ending Time	14:00:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	4.63
Test Interval Temperature	7.4
Ambient Barometric Pressure (kPa)	101.0

Measurement	**Depth** (m)
Top of Upper Packer	3.08
Top of Test Interval	3.94
Bottom of Test Interv	5.32
Bottom of Lower Pacl	6.18

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\ s/m^3$)
1	13:12:30	13:35:45	1500	0.012	2474.78	0.24	1.69	99.31	337.7	28624.3
2	13:35:45	13:42:15	1950	0.015	2462.65	0.33	2.31	98.69	462.2	30135.0
3	13:42:15	13:51:00	2400	0.019	2445.03	0.47	3.23	97.77	641.7	33992.9
4	13:51:00	13:54:45	1950	0.015	2462.53	0.34	2.32	98.68	463.5	30215.3
5	13:54:45	14:00:00	1440	0.011	2475.48	0.24	1.65	99.35	330.6	29186.4





Packer Test: **230909-B-VERT-3**

Raw Data - Differential Manometer Measurement (mm H_2O)

		Gas Port Number [Measurement Depth (m)]						
	Measurement ID	**1 [1.0]**	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 131	***Initial Reading***	*-0.25*	*-1.00*	*-0.50*	*-0.25*	*-0.75*	*-0.50*	*-0.50*
	1	0.25	0.50	1.00	0.50	0.00	0.25	-0.50
	2	0.50	0.50	1.25	0.50	0.00	0.25	-0.50
	3	0.50	0.50	1.25	0.75	0.00	0.25	-0.50
	4	0.50	0.50	1.25	0.75	0.25	0.25	-0.50
	5	0.25	0.50	1.00	0.50	0.25	0.00	-0.50

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 130	***Initial Reading***	*-0.75*	*-0.75*	*-1.50*	*-0.50*	*-0.50*	*-0.25*
	1	-0.75	-1.00	-1.75	-0.50	-0.50	-0.50
	2	---	---	---	---	---	---
	3	-0.25	-0.50	-0.75	0.25	0.25	0.25
	4	---	---	---	---	---	---
	5	-0.50	-1.00	-1.25	-0.50	-0.50	-0.25

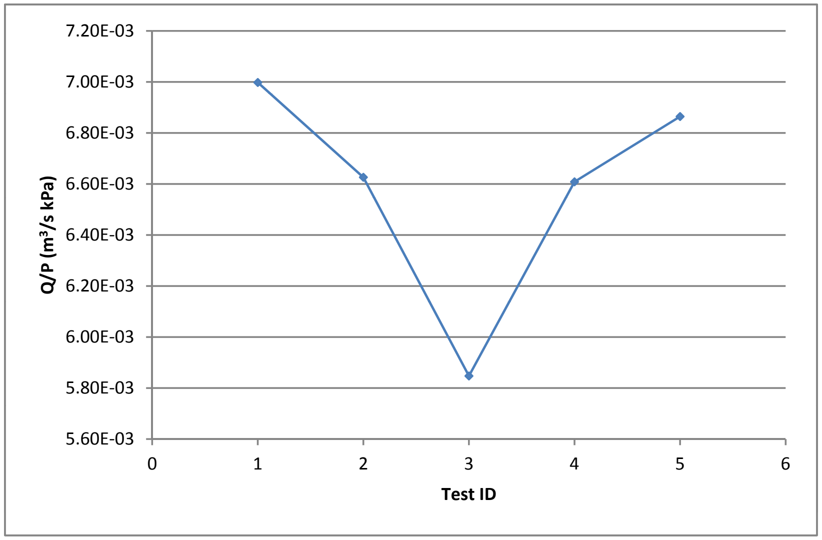
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 129	***Initial Reading***	*-1.00*	*-0.50*	*-1.50*	*-0.50*	*-0.75*	*-0.75*	*-0.25*
	1	-1.00	-0.50	-1.50	-0.50	-0.75	-0.25	-0.50
	2	---	---	---	---	---	---	---
	3	-1.00	-0.50	-1.50	-0.75	-0.75	-0.50	-0.25
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---

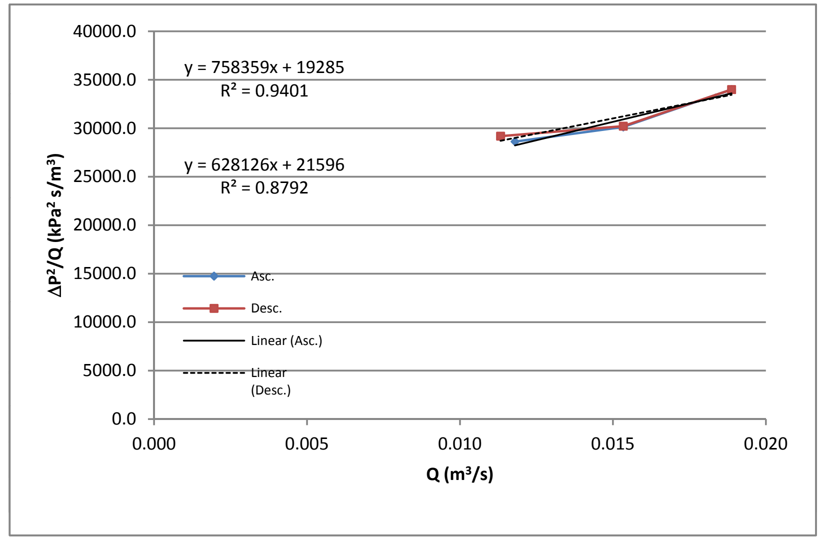
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 131	1	0.50	1.50	1.50	0.75	0.75	0.75	0.00
	2	0.75	1.50	1.75	0.75	0.75	0.75	0.00
	3	0.75	1.50	1.75	1.00	0.75	0.75	0.00
	4	0.75	1.50	1.75	1.00	1.00	0.75	0.00
	5	0.50	1.50	1.50	0.75	1.00	0.50	0.00

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 130	1	0.00	-0.25	-0.25	0.00	0.00	-0.25
	2	---	---	---	---	---	---
	3	0.50	0.25	0.75	0.75	0.75	0.50
	4	---	---	---	---	---	---
	5	0.25	-0.25	0.25	0.00	0.00	0.00

		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 129	1	0.00	0.00	0.00	0.00	0.00	0.50	-0.25
	2	---	---	---	---	---	---	---
	3	0.00	0.00	0.00	-0.25	0.00	0.25	0.00
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---





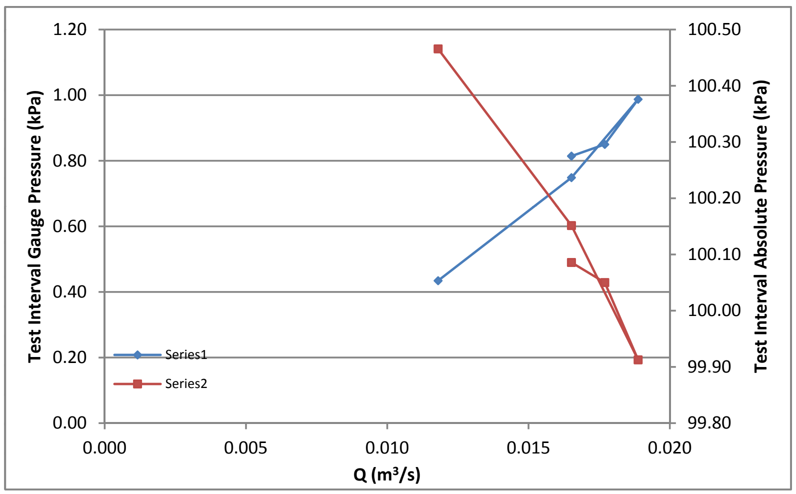
Q/P (m^3/s kPa)
7.00E-03
6.63E-03
5.85E-03
6.61E-03
6.86E-03

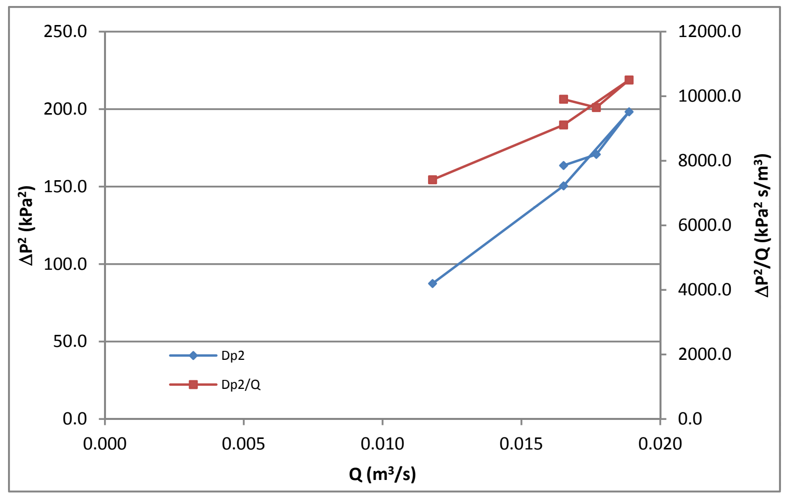
Packer Test:	230909-B-VERT-4
Client:	Syncrude Canada Ltd.

Test Date	Sept 23/09
Beginning Time	14:06:15
Ending Time	14:37:45
Test Interval Length (m)	1.38
Center of Test Interval (m)	5.665
Test Interval Temperature	7.6
Ambient Barometric Pressure (kPa)	100.9

Measurement	**Depth** (m)
Top of Upper Packer	4.46
Top of Test Interval	5.32
Bottom of Test Interv	6.01
Bottom of Lower Pacl	6.87

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\ s/m^3$)
1	14:12:00	14:14:30	2100	0.017	2491.60	0.12	0.81	100.09	163.6	9907.0
2	14:14:30	14:23:00	2250	0.018	2490.91	0.12	0.85	100.05	170.8	9650.0
3	14:23:00	14:29:45	2400	0.019	2488.26	0.14	0.99	99.91	198.3	10503.3
4	14:29:45	14:33:30	2100	0.017	2492.87	0.11	0.75	100.15	150.5	9111.0
5	14:33:30	14:36:45	1500	0.012	2498.93	0.06	0.43	100.47	87.5	7412.3





Packer Test: **230909-B-VERT-4**

Raw Data - Differential Manometer Measurement (mm H_2O)

CMT 131

				Gas Port Number [Measurement Depth (m)]			
Measurement ID	**1 [1.0]**	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
Initial Reading	*-0.25*	*-1.00*	*-0.50*	*-0.25*	*-0.75*	*-0.50*	*-0.50*
1	0.25	0.00	0.75	1.00	0.50	0.50	-0.25
2	0.25	0.25	1.00	1.25	0.50	0.50	-0.25
3	0.25	0.50	1.00	1.25	0.75	0.50	0.00
4	0.25	0.25	1.00	1.00	0.25	0.50	0.00
5	0.25	0.00	0.75	1.00	0.25	0.25	0.00

CMT 130

	1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
Initial Reading	*-0.75*	*-0.75*	*-1.50*	*-0.50*	*-0.50*	*-0.25*
1	0.00	0.00	-0.50	0.25	0.25	0.25
2	---	---	---	---	---	---
3	-0.50	-0.50	-1.25	-0.50	-0.25	-0.25
4	---	---	---	---	---	---
5	---	---	---	---	---	---

CMT 129

	1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
Initial Reading	*-1.00*	*-0.50*	*-1.50*	*-0.50*	*-0.75*	*-0.75*	*-0.25*
1	-1.00	-0.75	-1.50	-0.50	-0.75	-0.75	-0.50
2	---	---	---	---	---	---	---
3	---	---	---	---	---	---	---
4	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---

Corrected Data - Net Differential Manometer Measurement (mm H_2O)

CMT 131

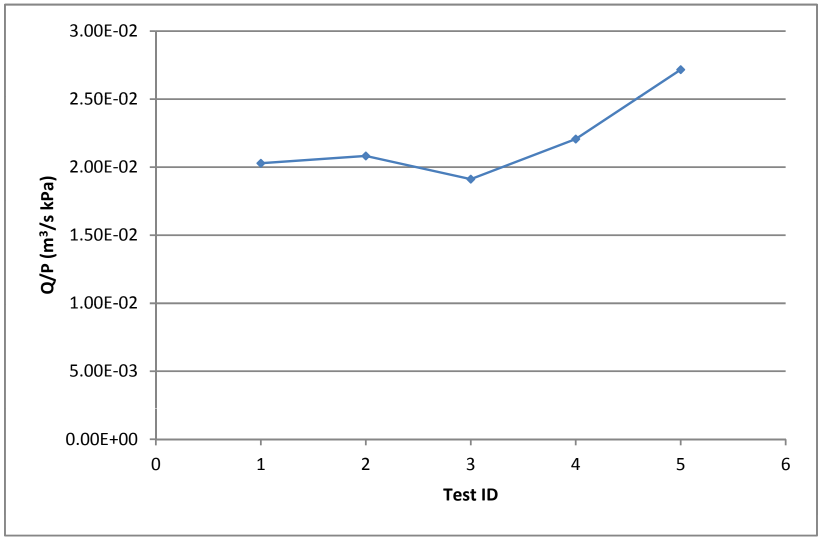
Measurement				Gas Port Number [Measurement Depth (m)]			
ID	**1 [1.0]**	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
1	0.50	1.00	1.25	1.25	1.25	1.00	0.25
2	0.50	1.25	1.50	1.50	1.25	1.00	0.25
3	0.50	1.50	1.50	1.50	1.50	1.00	0.50
4	0.50	1.25	1.50	1.25	1.00	1.00	0.50
5	0.50	1.00	1.25	1.25	1.00	0.75	0.50

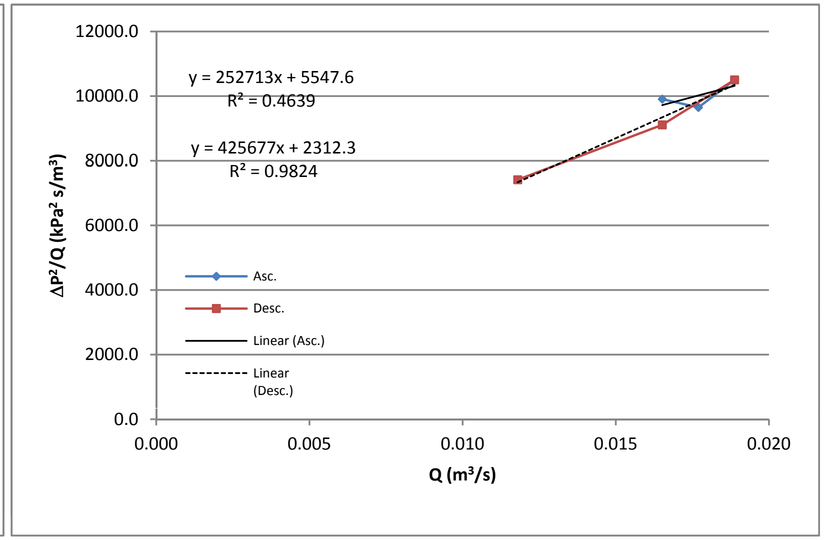
CMT 130

	1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
1	0.75	0.75	1.00	0.75	0.75	0.50
2	---	---	---	---	---	---
3	0.25	0.25	0.25	0.00	0.25	0.00
4	---	---	---	---	---	---
5	---	---	---	---	---	---

CMT 129

	1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
1	0.00	-0.25	0.00	0.00	0.00	0.00	-0.25
2	---	---	---	---	---	---	---
3	---	---	---	---	---	---	---
4	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---





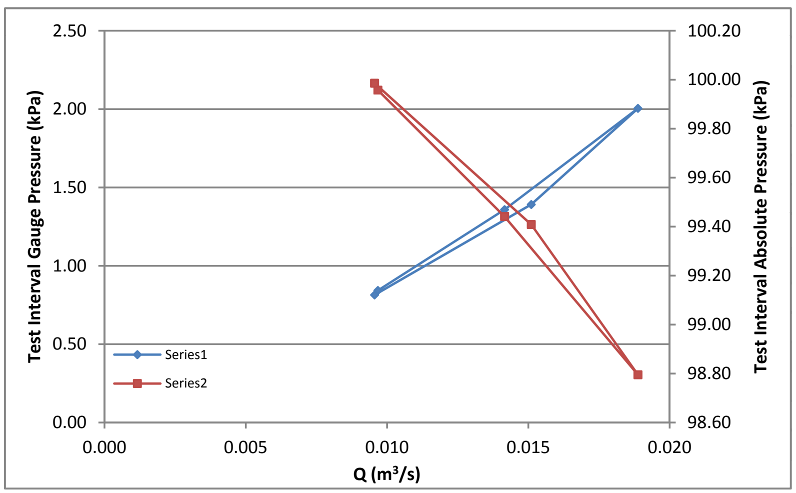
Q/P (m^3/s kPa)
2.03E-02
2.08E-02
1.91E-02
2.21E-02
2.72E-02

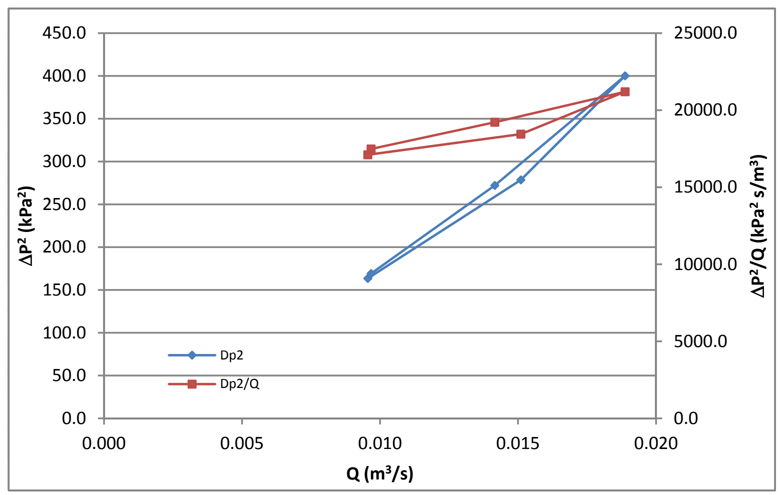
Packer Test:	**230909-B-VERT-5**
Client:	Syncrude Canada Ltd.

Test Date	Sept 23/09
Beginning Time	14:41:45
Ending Time	15:14:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	7.39
Test Interval Temperature	8.1
Ambient Barometric Pressure (kPa)	100.8

Measurement	**Depth** (m)
Top of Upper Packer	5.84
Top of Test Interval	6.70
Bottom of Test Interv	8.08
Bottom of Lower Pacl	8.94

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\ s/m^3$)
1	14:46:30	14:51:15	1230	0.010	2491.05	0.12	0.84	99.96	169.2	17483.9
2	14:51:15	14:56:45	1800	0.014	2481.10	0.20	1.36	99.44	272.1	19216.9
3	14:56:45	15:04:30	2400	0.019	2468.63	0.29	2.00	98.80	400.1	21196.3
4	15:04:30	15:08:15	1920	0.015	2480.47	0.20	1.39	99.41	278.6	18444.8
5	15:08:15	15:11:45	1215	0.010	2491.60	0.12	0.81	99.99	163.5	17106.2





Packer Test: **230909-B-VERT-5**

Raw Data - Differential Manometer Measurement (mm H_2O)

CMT 131

Measurement ID	Gas Port Number [Measurement Depth (m)] 1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
Initial Reading	*-0.25*	*-1.00*	*-0.50*	*-0.25*	*-0.75*	*-0.50*	*-0.50*
1	-0.25	-0.25	0.50	1.00	0.25	0.50	0.25
2	-0.25	0.00	0.75	1.25	0.25	0.50	0.25
3	0.25	0.00	0.75	1.25	0.50	0.75	0.25
4	-0.25	0.00	0.75	1.25	0.50	0.50	0.25
5	-0.25	-0.25	0.50	0.75	0.00	0.25	0.00

CMT 130

	1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
Initial Reading	*-0.75*	*-0.75*	*-1.50*	*-0.50*	*-0.50*	*-0.25*
1	---	---	---	---	---	---
2	---	---	---	---	---	---
3	-0.50	-0.75	-1.50	-0.75	-0.25	-0.25
4	---	---	---	---	---	---
5	---	---	---	---	---	---

CMT 129

	1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
Initial Reading	*-1.00*	*-0.50*	*-1.50*	*-0.50*	*-0.75*	*-0.75*	*-0.25*
1	---	---	---	---	---	---	---
2	---	---	---	---	---	---	---
3	-1.00	-1.50	-1.50	-0.50	-0.50	-0.50	-0.50
4	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---

Corrected Data - Net Differential Manometer Measurement (mm H_2O)

CMT 131

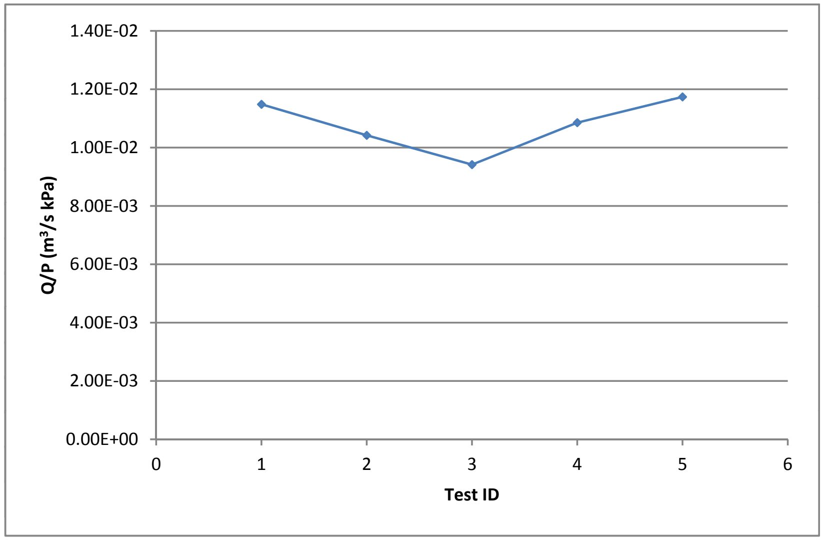
Measurement ID	Gas Port Number [Measurement Depth (m)] 1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
1	0.00	0.75	1.00	1.25	1.00	1.00	0.75
2	0.00	1.00	1.25	1.50	1.00	1.00	0.75
3	0.50	1.00	1.25	1.50	1.25	1.25	0.75
4	0.00	1.00	1.25	1.50	1.25	1.00	0.75
5	0.00	0.75	1.00	1.00	0.75	0.75	0.50

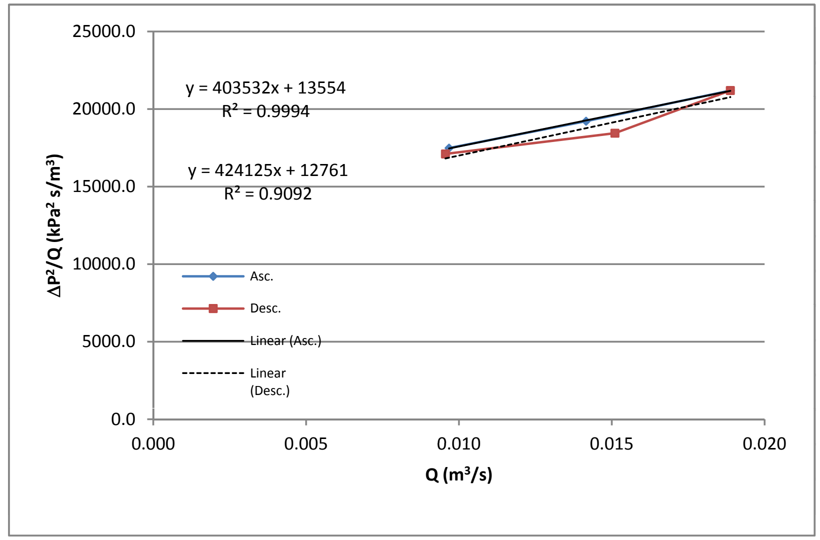
CMT 130

	1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
1	---	---	---	---	---	---
2	---	---	---	---	---	---
3	0.25	0.00	0.00	-0.25	0.25	0.00
4	---	---	---	---	---	---
5	---	---	---	---	---	---

CMT 129

	1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
1	---	---	---	---	---	---	---
2	---	---	---	---	---	---	---
3	0.00	-1.00	0.00	0.00	0.25	0.25	-0.25
4	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---





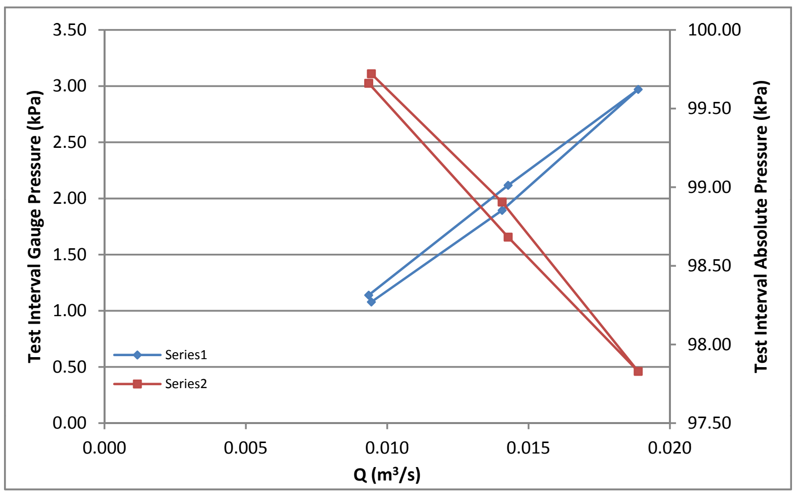
Q/P (m^3/s kPa)
1.15E-02
1.04E-02
9.42E-03
1.09E-02
1.17E-02

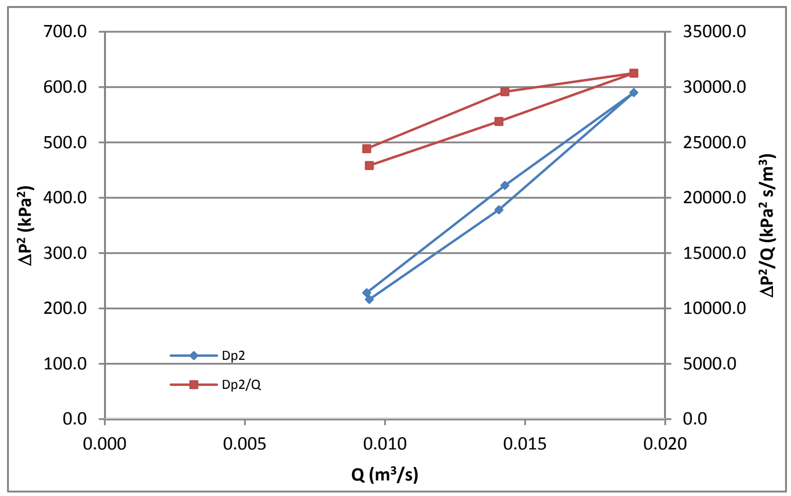
Packer Test:	230909-B-VERT-6
Client:	Syncrude Canada Ltd.

Test Date	Sept 23/09
Beginning Time	15:19:00
Ending Time	15:42:15
Test Interval Length (m)	1.38
Center of Test Interval (m)	8.77
Test Interval Temperature	8.6
Ambient Barometric Pressure (kPa)	100.8

Measurement	Depth (m)
Top of Upper Packer	7.22
Top of Test Interval	8.08
Bottom of Test Interv	9.46
Bottom of Lower Pacl	10.32

Flow Rate ID	Begin Time (HH:MM:SS)	Ending Time (HH:MM:SS)	Pump Rate (ft^3/hr)	Pump Rate (m^3/s)	Transducer Output (mV)	Gauge Pressure (psi)	Gauge Pressure (kPa)	Absolute Pressure (kPa)	ΔP^2 (kPa^2)	$\Delta P^2/Q$ ($kPa^2\ s/m^3$)
1	15:23:15	15:27:00	1188	0.009	2485.33	0.16	1.14	99.66	228.3	24435.4
2	15:27:00	15:31:00	1815	0.014	2466.47	0.31	2.12	98.68	422.3	29581.8
3	15:31:00	15:34:30	2400	0.019	2450.00	0.43	2.97	97.83	590.1	31257.0
4	15:34:30	15:37:45	1788	0.014	2470.77	0.27	1.89	98.91	378.3	26895.0
5	15:37:45	15:40:30	1200	0.009	2486.50	0.16	1.08	99.72	216.3	22913.6





Packer Test: **230909-B-VERT-6**

Raw Data - Differential Manometer Measurement (mm H_2O)

CMT 131

Measurement ID	**Gas Port Number [Measurement Depth (m)]**						
	1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0**	**6 [13.0]**	**7 [15.0]**
Initial Reading	*-0.25*	*-1.00*	*-0.50*	*-0.25*	*-0.75*	*-0.50*	*-0.50*
1	-0.25	-0.25	0.50	0.75	0.25	0.25	0.25
2	0.00	0.00	0.50	0.75	0.50	0.50	0.25
3	-0.25	0.00	0.50	1.00	0.75	0.50	0.25
4	-0.25	0.00	0.50	0.75	0.50	0.25	0.25
5	-0.25	0.00	0.50	0.75	0.50	0.00	0.00

CMT 130

	1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
Initial Reading	*-0.75*	*0.00*	*-0.25*	*-1.00*	*-0.50*	*-0.25*
1	---	---	---	---	---	---
2	---	---	---	---	---	---
3	---	---	---	---	---	---
4	---	---	---	---	---	---
5	---	---	---	---	---	---

CMT 129

	1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0**	**6 [13.0]**	**7 [15.0]**
Initial Reading	*-1.00*	*-0.50*	*-1.50*	*-0.50*	*-0.75*	*-0.75*	*-0.25*
1	---	---	---	---	---	---	---
2	---	---	---	---	---	---	---
3	---	---	---	---	---	---	---
4	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---

Corrected Data - Net Differential Manometer Measurement (mm H_2O)

CMT 131

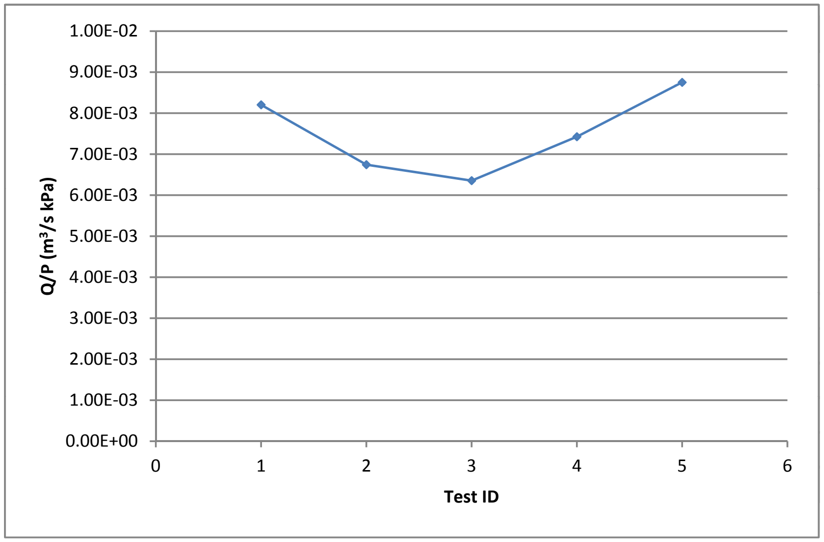
Measurement ID	**Gas Port Number [Measurement Depth (m)]**						
	1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0**	**6 [13.0]**	**7 [15.0]**
1	0.00	0.75	1.00	1.00	1.00	0.75	0.75
2	0.25	1.00	1.00	1.00	1.25	1.00	0.75
3	0.00	1.00	1.00	1.25	1.50	1.00	0.75
4	0.00	1.00	1.00	1.00	1.25	0.75	0.75
5	0.00	1.00	1.00	1.00	1.25	0.50	0.50

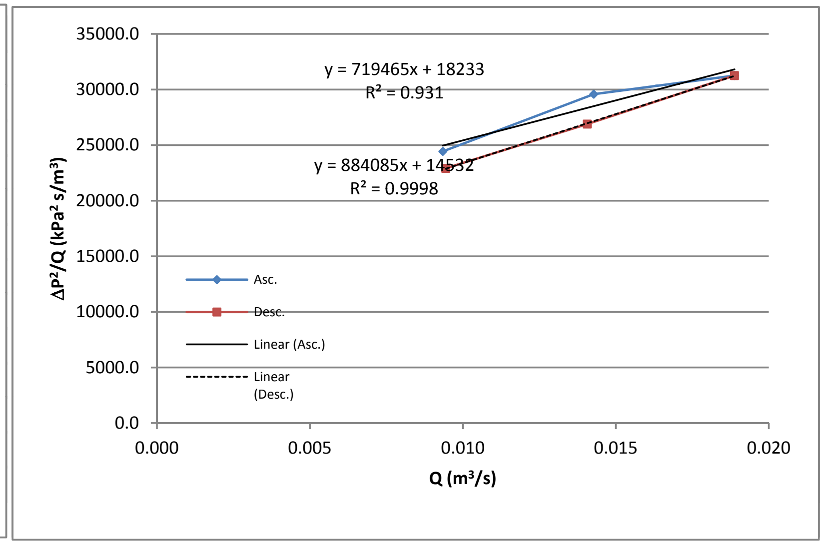
CMT 130

	1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
1	---	---	---	---	---	---
2	---	---	---	---	---	---
3	---	---	---	---	---	---
4	---	---	---	---	---	---
5	---	---	---	---	---	---

CMT 129

	1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0**	**6 [13.0]**	**7 [15.0]**
1	---	---	---	---	---	---	---
2	---	---	---	---	---	---	---
3	---	---	---	---	---	---	---
4	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---



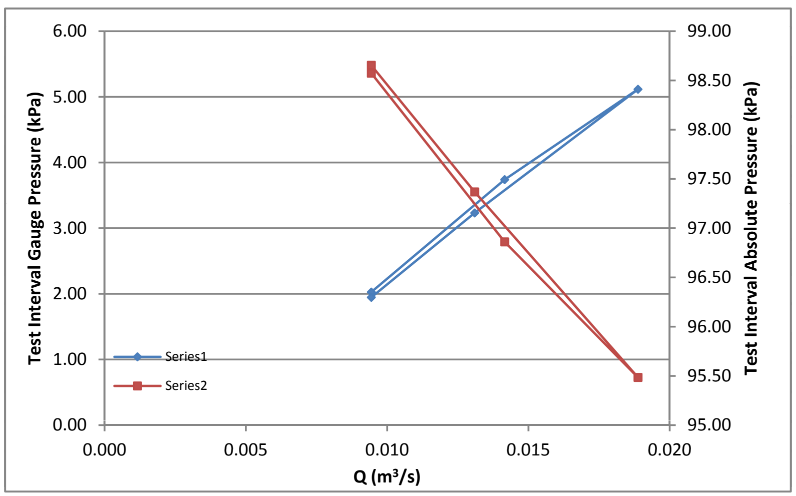


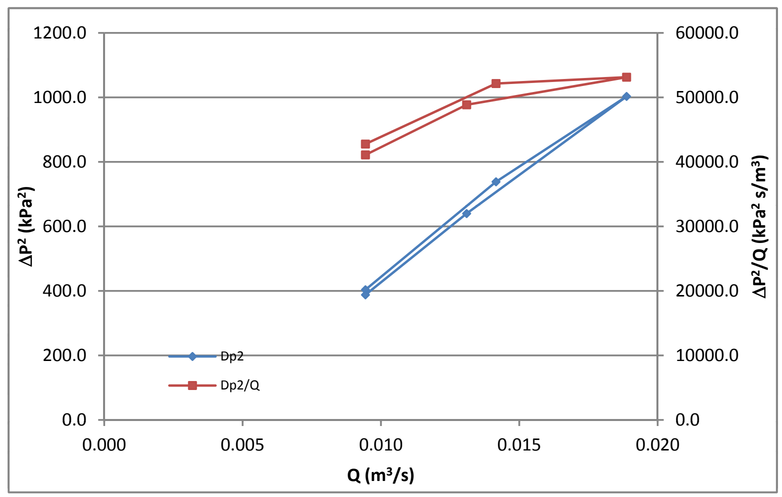
Q/P (m^3/s kPa)
8.20E-03
6.74E-03
6.35E-03
7.43E-03
8.75E-03

Packer Test:	**230909-B-VERT-7**
Client:	Syncrude Canada Ltd.
Test Date	Sept 23/09
Beginning Time	16:42:45
Ending Time	18:03:45
Test Interval Length (m)	1.38
Center of Test Interval (m)	10.15
Test Interval Temperature	9.0
Ambient Barometric Pressure (kPa)	100.6

Measurement	**Depth** (m)
Top of Upper Packer	8.60
Top of Test Interval	9.46
Bottom of Test Interv	10.84
Bottom of Lower Pacl	11.70

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\ s/m^3$)
1	16:46:45	16:51:30	1200	0.009	2468.21	0.29	2.03	98.57	403.7	42765.6
2	16:51:30	16:57:15	1800	0.014	2435.17	0.54	3.74	96.86	738.4	52149.6
3	16:57:15	17:06:15	2400	0.019	2408.63	0.74	5.12	95.48	1003.0	53132.8
4	17:06:15	17:19:00	1665	0.013	2444.96	0.47	3.23	97.37	639.8	48853.8
5	17:19:00	17:26:00	1200	0.009	2469.76	0.28	1.95	98.65	387.8	41088.7





Packer Test: **230909-B-VERT-7**

Raw Data - Differential Manometer Measurement (mm H_2O)

CMT 131

Measurement ID	**1 [1.0]**	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
	Gas Port Number [Measurement Depth (m)]						
Initial Reading	*-0.25*	*-1.00*	*-0.50*	*-0.25*	*-0.75*	*-0.50*	*-0.50*
1	-0.50	-0.25	-0.25	0.50	0.50	0.50	0.00
2	-0.25	-0.25	0.25	0.50	0.75	1.00	0.50
3	-0.50	0.00	0.75	0.75	1.25	1.50	1.00
4	-0.50	0.00	0.25	0.75	0.75	0.75	0.50
5	-0.50	-0.25	0.00	0.50	0.50	0.75	0.50

CMT 130

	1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
Initial Reading	*-0.75*	*-0.75*	*-1.50*	*-0.50*	*-0.50*	*-0.25*
1	---	---	---	---	---	---
2	---	---	---	---	---	---
3	-0.75	-0.75	-1.50	-0.50	-0.50	-0.25
4	-0.50	-0.25	-0.75	0.00	0.00	0.25
5	-0.75	-0.50	-1.50	-0.50	-0.25	-0.25

CMT 129

	1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
Initial Reading	*-1.00*	*-0.50*	*-1.50*	*-0.50*	*-0.75*	*-0.75*	*-0.25*
1	---	---	---	---	---	---	---
2	---	---	---	---	---	---	---
3	-1.00	-0.75	-1.25	-0.50	-0.25	-0.25	-0.75
4	*-1.00*	*-0.75*	*-1.25*	*-0.50*	*0.00*	*0.00*	*-0.50*
5	---	---	---	---	---	---	---

Corrected Data - Net Differential Manometer Measurement (mm H_2O)

CMT 131

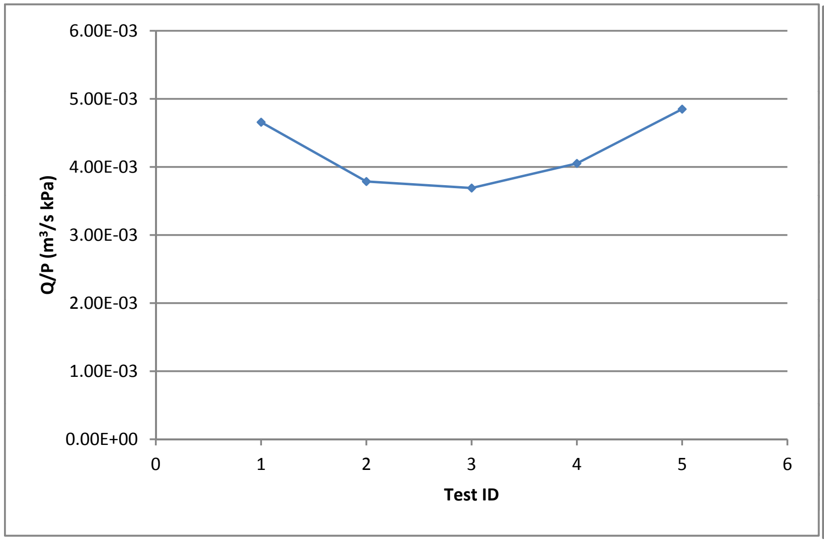
Measurement ID	**1 [1.0]**	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
	Gas Port Number [Measurement Depth (m)]						
1	-0.25	0.75	0.25	0.75	1.25	1.00	0.50
2	0.00	0.75	0.75	0.75	1.50	1.50	1.00
3	-0.25	1.00	1.25	1.00	2.00	2.00	1.50
4	-0.25	1.00	0.75	1.00	1.50	1.25	1.00
5	-0.25	0.75	0.50	0.75	1.25	1.25	1.00

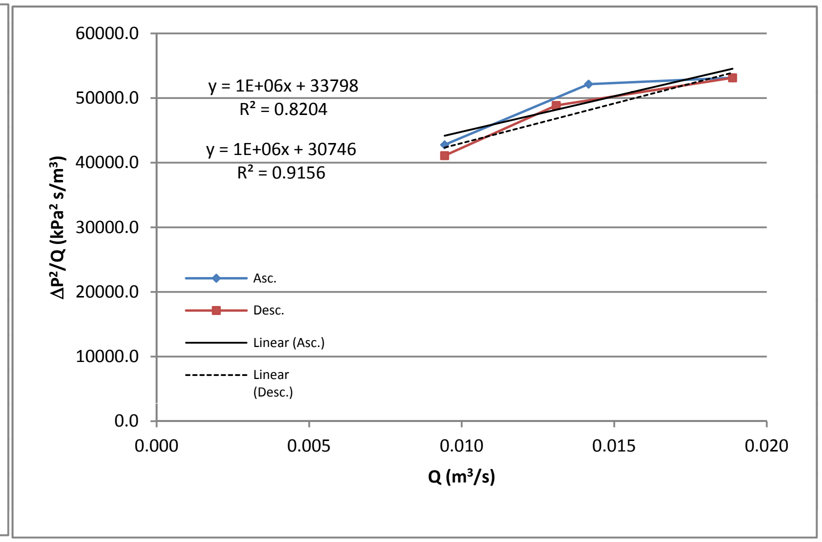
CMT 130

	1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
1	---	---	---	---	---	---
2	---	---	---	---	---	---
3	0.00	0.00	0.00	0.00	0.00	0.00
4	0.25	0.50	0.75	0.50	0.50	0.50
5	0.00	0.25	0.00	0.00	0.25	0.00

CMT 129

	1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
1	---	---	---	---	---	---	---
2	---	---	---	---	---	---	---
3	0.00	-0.25	0.25	0.00	0.50	0.50	-0.50
4	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---





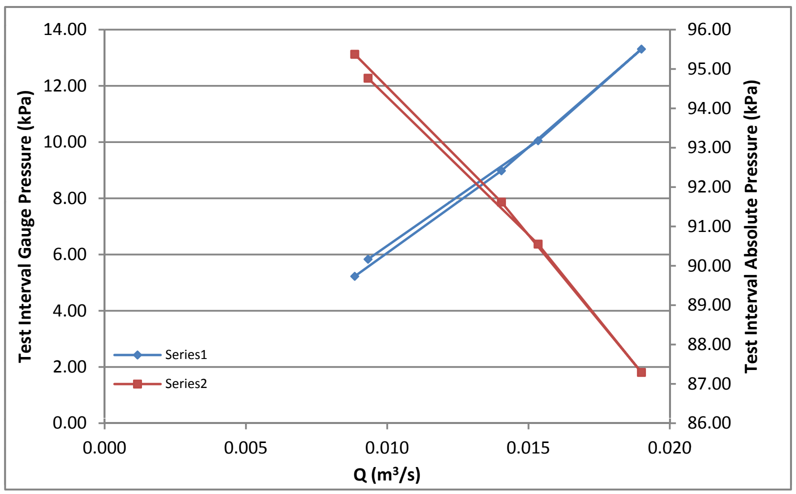
Q/P (m^3/s kPa)
4.66E-03
3.79E-03
3.69E-03
4.05E-03
4.85E-03

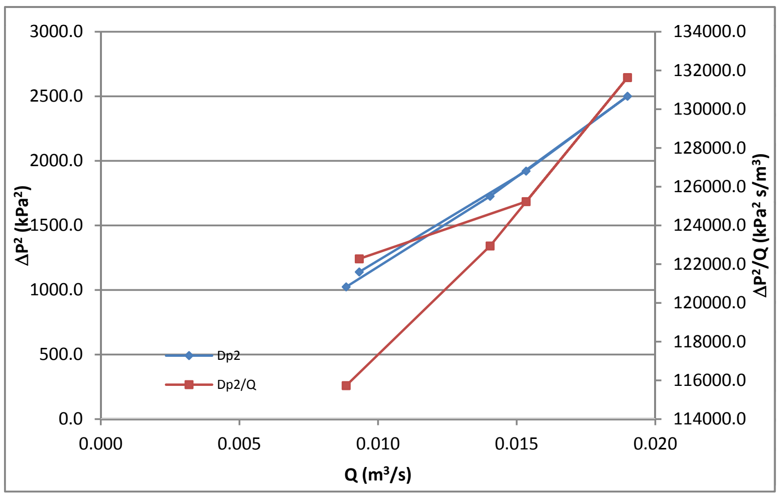
Packer Test:	**230909-B-VERT-8**
Client:	Syncrude Canada Ltd.

Test Date	Sept 23/09
Beginning Time	18:09:45
Ending Time	18:31:15
Test Interval Length (m)	1.38
Center of Test Interval (m)	11.52
Test Interval Temperature	8.7
Ambient Barometric Pressure (kPa)	100.6

Measurement	**Depth** (m)
Top of Upper Packer	9.98
Top of Test Interval	10.84
Bottom of Test Interv	12.20
Bottom of Lower Pacl	13.06

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2 s/m^3$)
1	18:13:30	18:16:45	1185	0.009	2394.77	0.84	5.83	94.77	1139.7	122275.0
2	18:16:45	18:20:15	1950	0.015	2313.46	1.45	10.05	90.55	1920.8	125229.7
3	18:20:15	18:23:15	2415	0.019	2250.58	1.93	13.31	87.29	2500.5	131633.3
4	18:23:15	18:26:30	1785	0.014	2334.08	1.30	8.98	91.62	1726.1	122939.8
5	18:26:30	18:29:15	1125	0.009	2406.50	0.76	5.23	95.37	1024.1	115729.9





Packer Test: **230909-B-VERT-8**

Raw Data - Differential Manometer Measurement (mm H_2O)

CMT 131

Measurement ID	1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
	Gas Port Number [Measurement Depth (m)]						
Initial Reading	*-0.50*	*-0.50*	*-0.50*	*-0.25*	*-0.75*	*-0.50*	*-0.25*
1	-0.25	-0.25	-0.25	0.50	1.00	1.00	0.50
2	-0.25	-0.25	-0.25	0.75	1.50	1.25	1.00
3	-0.25	-0.25	0.00	0.75	1.75	1.50	1.50
4	-0.25	-0.25	0.00	0.75	1.25	1.25	1.00
5	-0.25	-0.25	0.00	0.50	1.00	1.00	0.75

CMT 130

	1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
Initial Reading	*-0.75*	*-0.75*	*-1.50*	*-0.50*	*-0.50*	*-0.25*
1	---	---	---	---	---	---
2	---	---	---	---	---	---
3	---	---	---	---	---	---
4	---	---	---	---	---	---
5	---	---	---	---	---	---

CMT 129

	1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
Initial Reading	*-1.00*	*-0.50*	*-1.00*	*-0.50*	*-0.75*	*-0.50*	*-0.75*
1	---	---	---	---	---	---	---
2	---	---	---	---	---	---	---
3	---	---	---	---	---	---	---
4	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---

Corrected Data - Net Differential Manometer Measurement (mm H_2O)

CMT 131

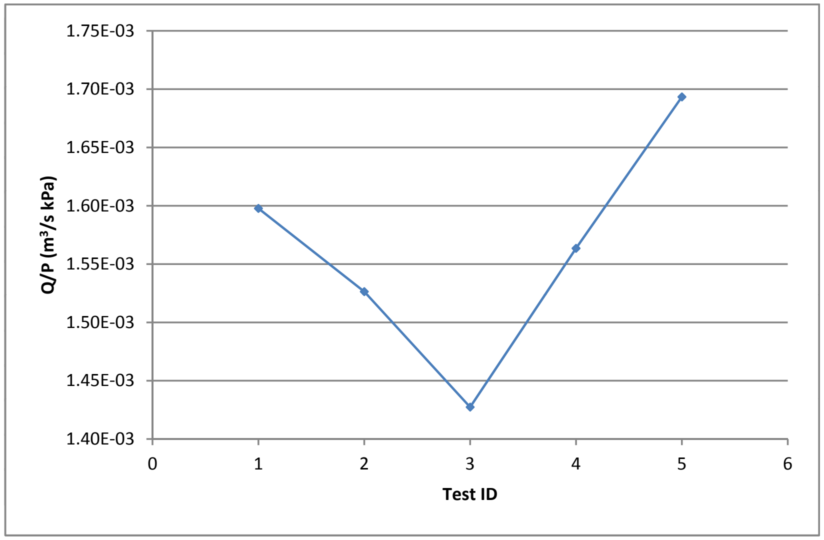
Measurement ID	1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
	Gas Port Number [Measurement Depth (m)]						
1	0.25	0.25	0.25	0.75	1.75	1.50	0.75
2	0.25	0.25	0.25	1.00	2.25	1.75	1.25
3	0.25	0.25	0.50	1.00	2.50	2.00	1.75
4	0.25	0.25	0.50	1.00	2.00	1.75	1.25
5	0.25	0.25	0.50	0.75	1.75	1.50	1.00

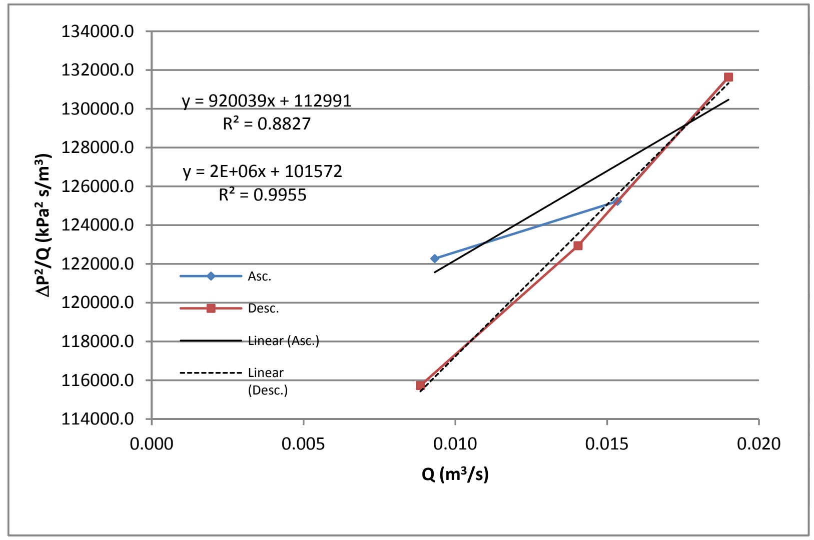
CMT 130

	1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
1	---	---	---	---	---	---
2	---	---	---	---	---	---
3	---	---	---	---	---	---
4	---	---	---	---	---	---
5	---	---	---	---	---	---

CMT 129

	1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
1	---	---	---	---	---	---	---
2	---	---	---	---	---	---	---
3	---	---	---	---	---	---	---
4	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---





Q/P (m^3/s kPa)
1.60E-03
1.53E-03
1.43E-03
1.56E-03
1.69E-03

Packer Test:	220909-B-ANG-1
Client:	Syncrude Canada Ltd.

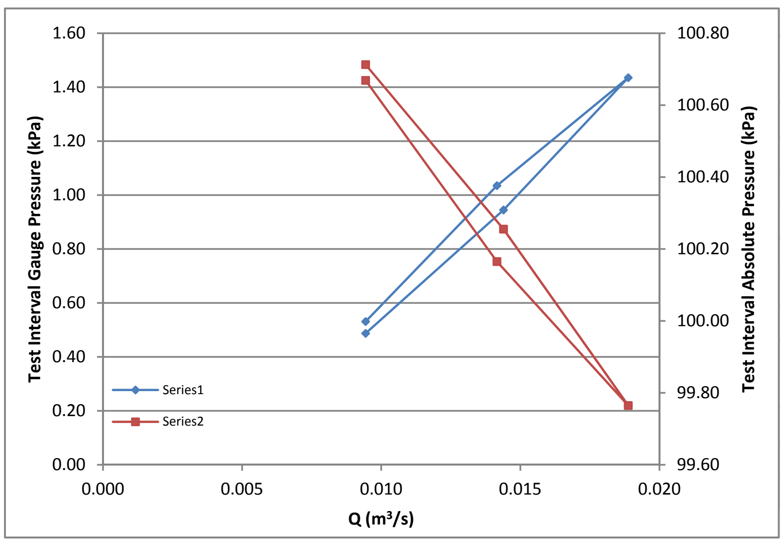
Test Date	22-Sep-09
Beginning Time	11:04:30
Ending Time	12:02:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	1.52
Test Interval Temperature	14.2
Ambient Barometric Pressure (kPa	101.2

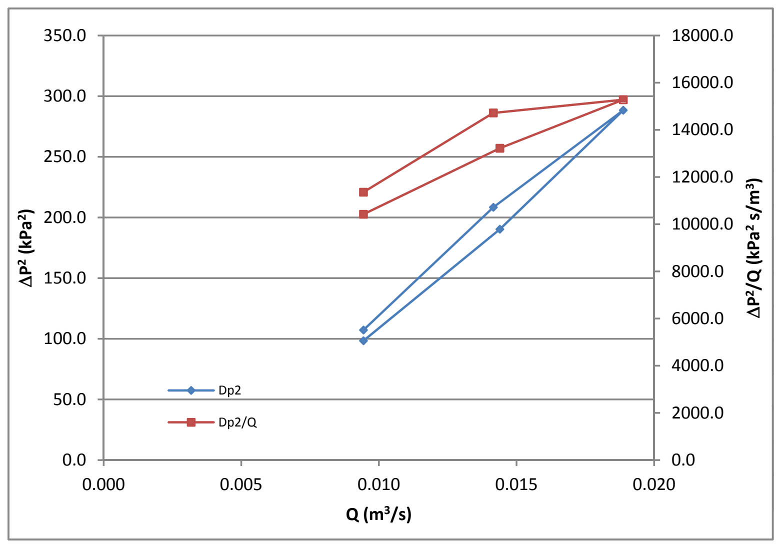
Measurement	Depth (m)
Top of Upper Packer	0.17
Top of Test Interval	1.03
Bottom of Test Interval	2.01
Bottom of Lower Packer	2.87

Flow Rate ID	Begin Time (HH:MM:SS)	Ending Time (HH:MM:SS)	Pump Rate (ft^3/hr)	Pump Rate (m^3/s)	Transducer Output (mV)	Gauge Pressure (psi)	Gauge Pressure (kPa)	Absolute Pressure (kPa)	ΔP^2 (kPa^2)	$\Delta P^2/Q$ ($kPa^2\ s/m^3$)
1	11:10:00	11:22:15	1200	0.009	2497.06	0.08	0.53	100.67	107.2	11357.4
2	18:15:00	11:31:00	1800	0.014	2487.34	0.15	1.03	100.17	208.4	14718.6
3	11:31:00	11:43:30	2400	0.019	2479.62	0.21	1.44	99.76	288.4	15278.8
4	11:43:00	11:52:30	1830	0.014	2489.08	0.14	0.94	100.26	190.3	13221.1
5	11:52:30	12:02:00	1200	0.009	2497.91	0.07	0.49	100.71	98.4	10421.1

Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.





Packer Test: **220909-B-ANG-1**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 144	*Initial Reading*	*-0.50*	*0.00*	*-0.25*	*0.50*	*-0.25*	*-0.50*	*-0.50*
	1	0.75	0.25	-0.25	0.50	0.00	-0.50	-0.50
	2	1.25	0.75	-0.25	0.50	-0.50	-0.75	-0.50
	3	1.50	0.75	-0.25	0.75	-0.25	-0.75	-0.50
	4	1.00	0.50	-0.25	0.75	-0.25	-0.50	-0.50
	5	0.75	0.25	-0.25	0.75	-0.50	-0.75	-0.50

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	*Initial Reading*	*-0.50*	*-0.50*	*-0.75*	*-0.50*	*-0.50*	*-0.75*
	1	-1.50	-1.00	-1.00	-1.00		
	2	-1.50	-1.00	-1.00	0.00	-0.50	-1.00
	3	-1.50	-1.50	-1.00	-1.00	-1.00	-1.00
	4	-0.75	-0.50	-1.00	-0.50	0.00	-0.75
	5	-1.25	-1.00	-1.00	-0.50	-0.50	-0.75

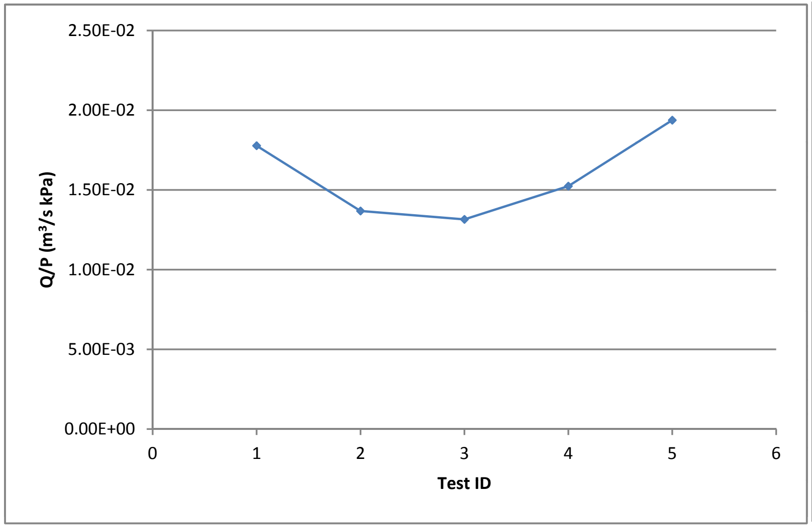
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 143	*Initial Reading*	*-1.00*	*-0.50*	*-1.00*	*-0.50*	*-0.25*	*-0.50*	*-0.50*
	1	-1.00	-0.50	-1.00	-0.50	-0.50	-0.25	-0.50
	2	-1.00	-0.50	-1.00	-0.50	-0.50	-0.50	-0.50
	3	-1.00	-0.50	-1.00	-0.50	-0.50	-0.25	-0.50
	4	-1.00	-0.50	-1.00	-0.50	-0.50	-0.25	-0.50
	5	-1.00	-0.50	-1.00	-0.50	-0.25	-0.25	-0.50

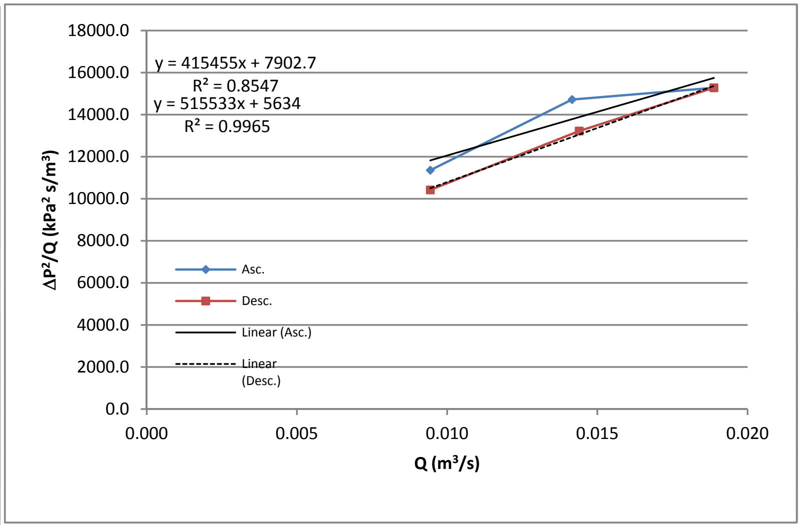
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 144	1	1.25	0.25	0.00	0.00	0.25	0.00	0.00
	2	1.75	0.75	0.00	0.00	-0.25	-0.25	0.00
	3	2.00	0.75	0.00	0.25	0.00	-0.25	0.00
	4	1.50	0.50	0.00	0.25	0.00	0.00	0.00
	5	1.25	0.25	0.00	0.25	-0.25	-0.25	0.00

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	1	-1.00	-0.50	-0.25	-0.50	0.50	0.75
	2	-1.00	-0.50	-0.25	0.50	0.00	-0.25
	3	-1.00	-1.00	-0.25	-0.50	-0.50	-0.25
	4	-0.25	0.00	-0.25	0.00	0.50	0.00
	5	-0.75	-0.50	-0.25	0.00	0.00	0.00

		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 143	1	0.00	0.00	0.00	0.00	-0.25	0.25	0.00
	2	0.00	0.00	0.00	0.00	-0.25	0.00	0.00
	3	0.00	0.00	0.00	0.00	-0.25	0.25	0.00
	4	0.00	0.00	0.00	0.00	-0.25	0.25	0.00
	5	0.00	0.00	0.00	0.00	0.00	0.25	0.00





Q/P (m^3/s kPa)
1.78E-02
1.37E-02
1.32E-02
1.52E-02
1.94E-02

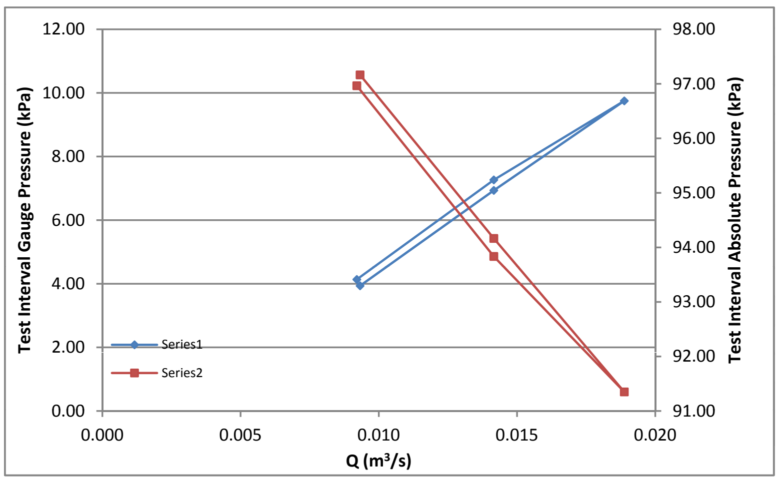
Packer Test:	**220909-B-ANG-2**
Client:	Syncrude Canada Ltd.
Test Date	22-Sep-09
Beginning Time	12:06:00
Ending Time	12:52:15
Test Interval Length (m)	1.38
Center of Test Interval (m)	2.495
Test Interval Temperature	10.5
Ambient Barometric Pressure (kPa)	101.1

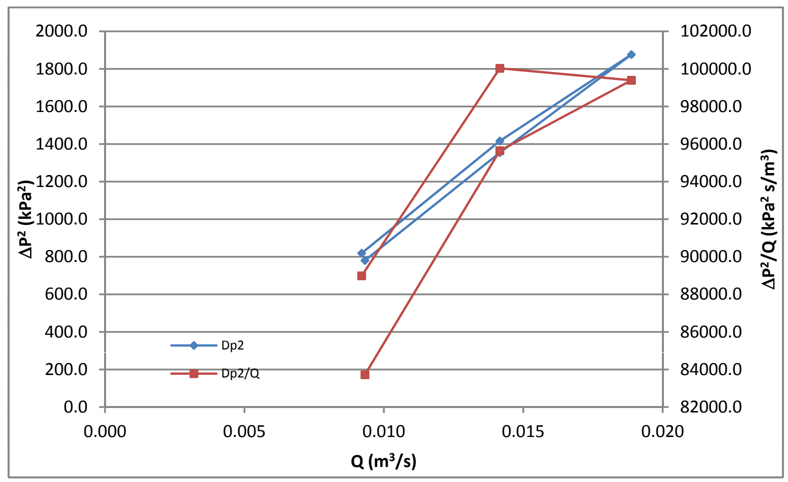
Measurement	**Depth** (m)
Top of Upper Packer	1.15
Top of Test Interval	2.01
Bottom of Test Interval	2.98
Bottom of Lower Packer	3.84

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\ s/m^3$)
1	12:10:45	12:19:00	1170	0.009	2427.55	0.60	4.13	96.97	818.9	88986.5
2	12:19:00	12:30:45	1800	0.014	2367.15	1.05	7.27	93.83	1416.3	100030.6
3	12:30:45	12:38:45	2400	0.019	2319.23	1.41	9.75	91.35	1876.4	99394.2
4	12:38:45	12:44:45	1800	0.014	2373.52	1.00	6.94	94.16	1354.2	95646.3
5	12:44:45	12:52:15	1185	0.009	2431.38	0.57	3.94	97.16	780.4	83720.9

Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.





Packer Test: **220909-B-ANG-2**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 144	***Initial Reading***	*-0.50*	*0.00*	*-0.25*	*0.50*	*-0.25*	*-0.50*	*-0.50*
	1	0.25	1.00	-0.25	0.50	-0.50	-0.50	-0.25
	2	0.50	1.50	0.25	0.75	-0.25	-0.50	-0.25
	3	0.75	1.75	0.50	0.75	-0.25	-0.50	-0.25
	4	0.50	1.25	0.25	0.50	-0.25	-0.50	-0.25
	5	0.25	1.00	0.25	0.50	-0.50	-0.75	-0.50

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	***Initial Reading***	*-0.50*	*-0.50*	*-0.75*	*-0.50*	*-0.50*	*-0.75*
	1	-0.75	-0.50	-0.50	0.00	0.00	0.00
	2	-0.75	-0.50	-0.75	-0.25	-0.50	-0.75
	3	-0.75	-0.50	-0.75	0.00	0.50	0.00
	4	-1.00	-0.50	-1.00	-0.50	-0.50	-0.25
	5	-1.00	-0.75	-1.00	-0.50	-0.50	-0.25

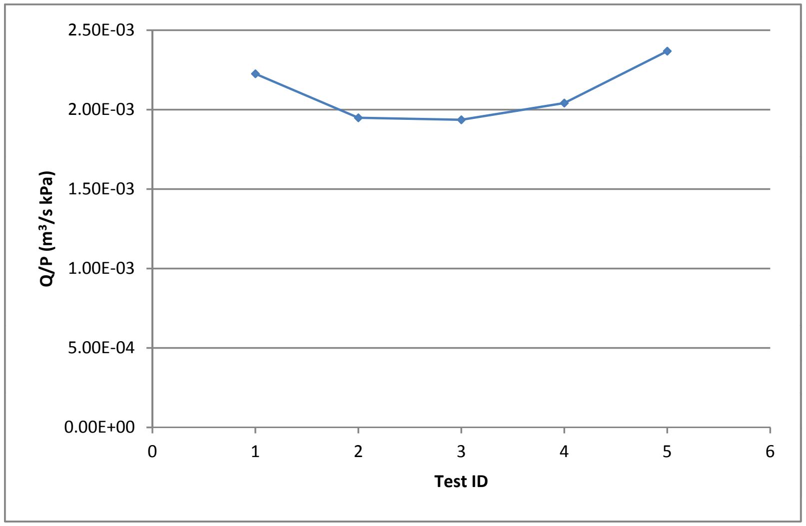
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 143	***Initial Reading***	*-1.00*	*-0.50*	*-1.00*	*-0.50*	*-0.25*	*-0.50*	*-0.50*
	1	-1.00	-0.50	-1.00	-0.50	-0.50	-0.25	-0.50
	2	-1.00	-0.25	-1.00	-0.50	-0.25	-0.25	-0.50
	3	-1.00	-0.25	-1.00	-0.50	-0.25	-0.25	-0.50
	4	---	---	---	---	---	---	---
	5	-1.00	-0.25	-1.00	-0.50	-0.25	-0.25	-0.50

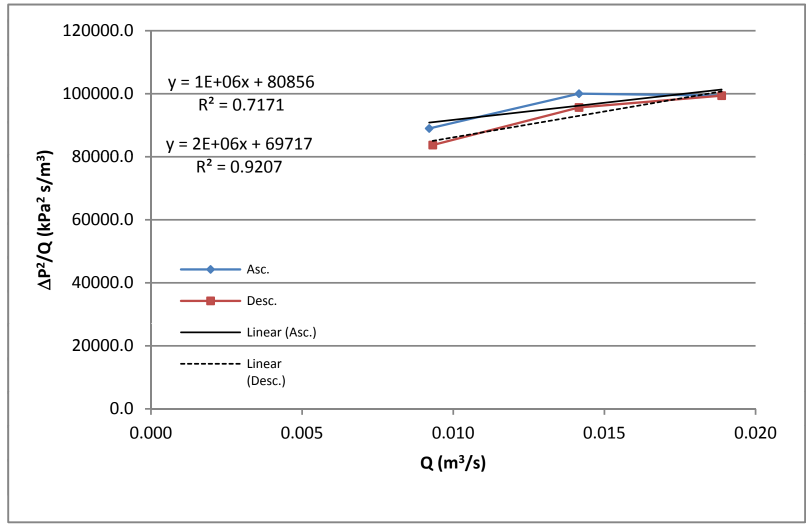
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 144	1	0.75	1.00	0.00	0.00	-0.25	0.00	0.25
	2	1.00	1.50	0.50	0.25	0.00	0.00	0.25
	3	1.25	1.75	0.75	0.25	0.00	0.00	0.25
	4	1.00	1.25	0.50	0.00	0.00	0.00	0.25
	5	0.75	1.00	0.50	0.00	-0.25	-0.25	0.00

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	1	-0.25	0.00	0.25	0.50	0.50	0.75
	2	-0.25	0.00	0.00	0.25	0.00	0.00
	3	-0.25	0.00	0.00	0.50	1.00	0.75
	4	-0.50	0.00	-0.25	0.00	0.00	0.50
	5	-0.50	-0.25	-0.25	0.00	0.00	0.50

		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 143	1	0.00	0.00	0.00	0.00	-0.25	0.25	0.00
	2	0.00	0.25	0.00	0.00	0.00	0.25	0.00
	3	0.00	0.25	0.00	0.00	0.00	0.25	0.00
	4	---	---	---	---	---	---	---
	5	0.00	0.25	0.00	0.00	0.00	0.25	0.00





Q/P (m^3/s kPa)
2.23E-03
1.95E-03
1.94E-03
2.04E-03
2.37E-03

Packer Test:	**220909-B-ANG-3**
Client:	Syncrude Canada Ltd.

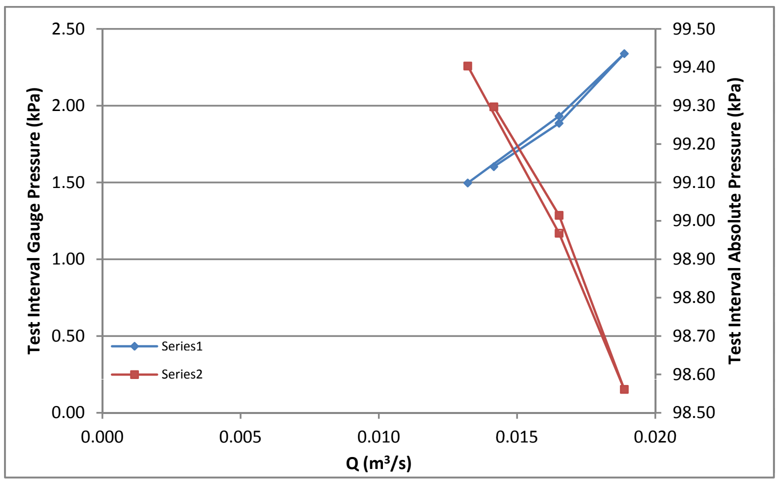
Test Date	22-Sep-09
Beginning Time	14:15:00
Ending Time	14:54:45
Test Interval Length (m)	1.38
Center of Test Interval (m)	3.47
Test Interval Temperature	8.4
Ambient Barometric Pressure (kPa)	100.9

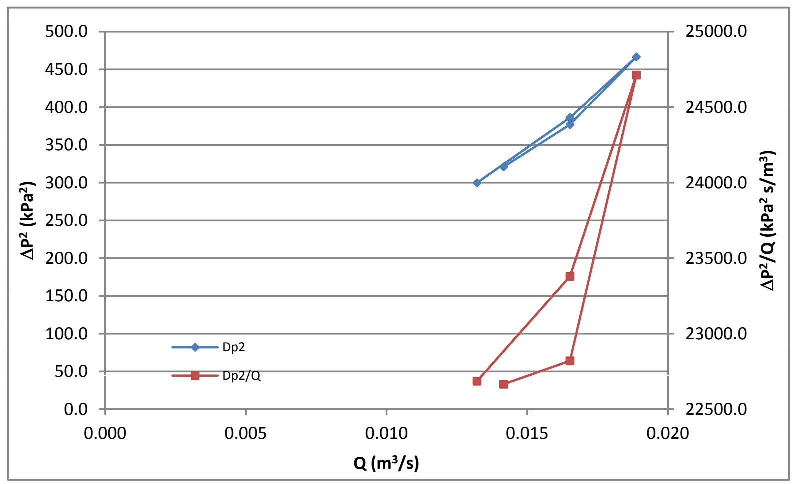
Measurement	**Depth** (m)
Top of Upper Packer	2.12
Top of Test Interval	2.98
Bottom of Test Interval	3.96
Bottom of Lower Packer	4.82

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\,s/m^3$)
1	14:18:00	14:28:15	1680	0.013	2478.44	0.22	1.50	99.40	299.8	22685.5
2	14:28:15	14:35:34	2100	0.017	2470.03	0.28	1.93	98.97	386.2	23379.3
3	14:35:45	14:44:00	2400	0.019	2462.19	0.34	2.34	98.56	466.5	24712.6
4	14:44:00	14:51:30	2100	0.017	2470.93	0.27	1.89	99.01	376.9	22820.1
5	14:51:30	14:54:45	1800	0.014	2476.38	0.23	1.60	99.30	320.9	22665.4

Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.





Packer Test: **220909-B-ANG-3**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
		Gas Port Number [Measurement Depth (m)]						
CMT 144	***Initial Reading***	*-0.50*	*0.00*	*-0.25*	*0.50*	*-0.25*	*-0.50*	*-0.50*
	1	0.25	1.50	0.25	0.50	0.00	-0.50	-0.50
	2	0.25	2.00	1.00	0.50	0.00	-0.50	-0.50
	3	0.50	2.50	1.50	0.50	0.00	-0.50	-0.50
	4	0.25	2.00	1.00	0.50	0.00	-0.50	-0.50
	5	0.00	1.75	1.00	0.50	0.00	-0.75	-0.50

		1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
CMT 147	***Initial Reading***	*-0.50*	*-0.50*	*-0.75*	*-0.50*	*-0.50*	*-0.75*
	1	-0.50	-0.50	-0.75	0.00	0.00	0.00
	2	-0.75	0.00	-0.50	0.00	0.25	0.50
	3	-0.75	-0.75	-0.75	-0.75	-0.75	-0.50
	4	-0.75	-0.75	-0.75	-0.75	-0.75	-0.75
	5	---	---	---	---	---	---

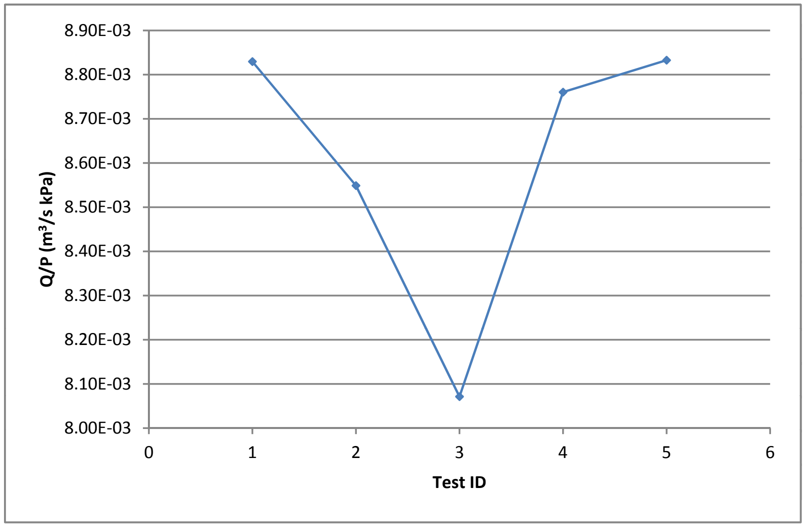
		1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
CMT 143	***Initial Reading***	*-1.00*	*-0.50*	*-1.00*	*-0.50*	*-0.25*	*-0.50*	*-0.50*
	1	-1.00	-0.50	-1.00	-0.50	-0.50	-0.75	-0.75
	2	-1.00	-0.50	-1.00	-0.50	-0.25	-0.50	-0.75
	3	-1.00	-0.50	-1.00	-0.50	-0.25	-0.75	-0.75
	4	-1.00	-0.50	-1.00	-0.50	-0.25	-0.25	-0.50
	5	---	---	---	---	---	---	---

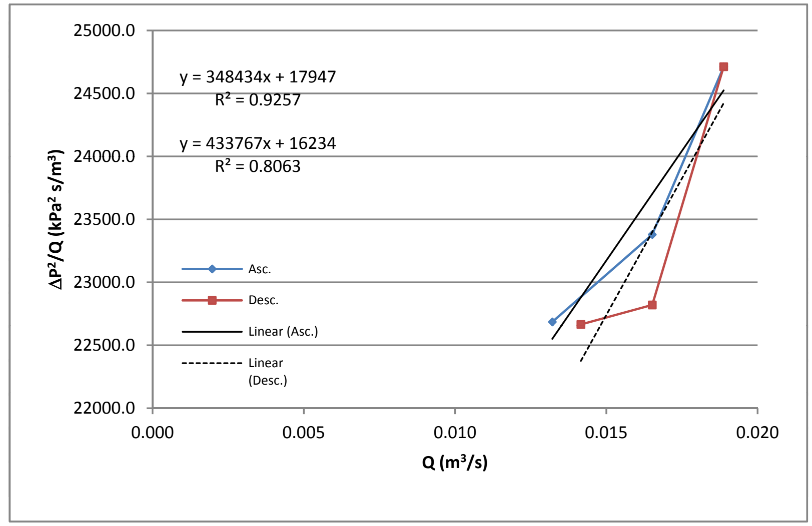
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
		Gas Port Number [Measurement Depth (m)]						
CMT 144	1	0.75	1.50	0.50	0.00	0.25	0.00	0.00
	2	0.75	2.00	1.25	0.00	0.25	0.00	0.00
	3	1.00	2.50	1.75	0.00	0.25	0.00	0.00
	4	0.75	2.00	1.25	0.00	0.25	0.00	0.00
	5	0.50	1.75	1.25	0.00	0.25	-0.25	0.00

		1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
CMT 147	1	0.00	0.00	0.00	0.50	0.50	0.75
	2	-0.25	0.50	0.25	0.50	0.75	1.25
	3	-0.25	-0.25	0.00	-0.25	-0.25	0.25
	4	-0.25	-0.25	0.00	-0.25	-0.25	0.00
	5	---	---	---	---	---	---

		1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
CMT 143	1	0.00	0.00	0.00	0.00	-0.25	-0.25	-0.25
	2	0.00	0.00	0.00	0.00	0.00	0.00	-0.25
	3	0.00	0.00	0.00	0.00	0.00	-0.25	-0.25
	4	0.00	0.00	0.00	0.00	0.00	0.25	0.00
	5	---	---	---	---	---	---	---





Q/P (m^3/s kPa)
8.83E-03
8.55E-03
8.07E-03
8.76E-03
8.83E-03

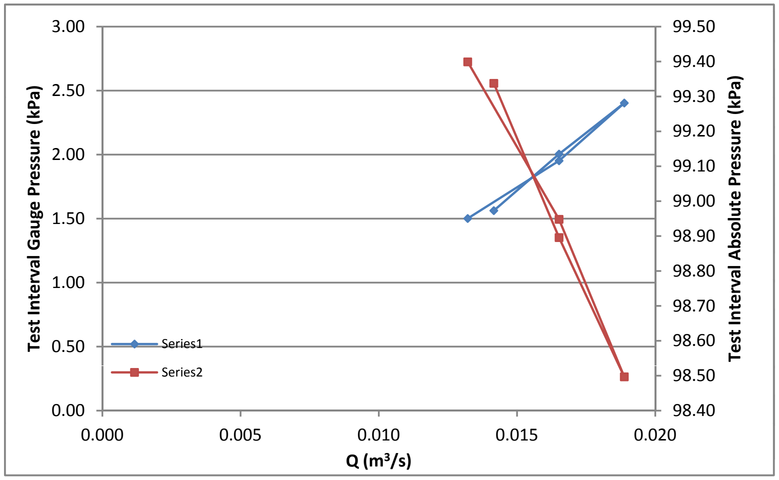
Packer Test:	**220909-B-ANG-4**
Client:	Syncrude Canada Ltd.
Test Date	22-Sep-09
Beginning Time	14:58:00
Ending Time	15:30:45
Test Interval Length (m)	1.38
Center of Test Interval (m)	4.45
Test Interval Temperature	7.6
Ambient Barometric Pressure (kPa)	100.9

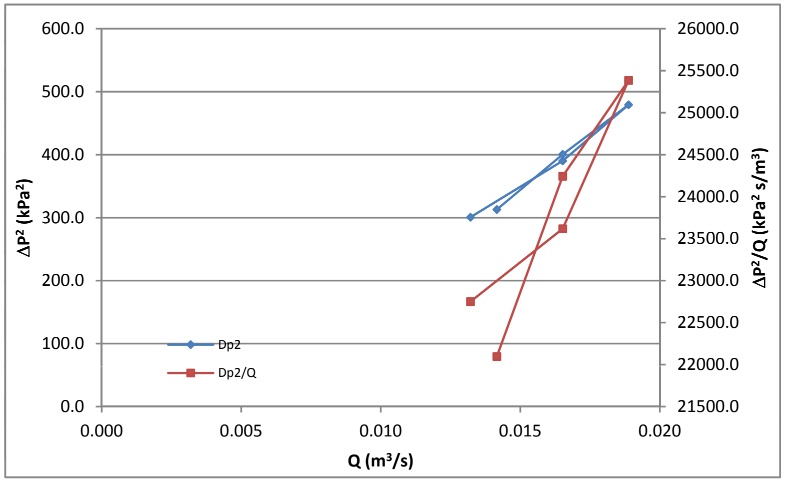
Measurement	**Depth** (m)
Top of Upper Packer	3.10
Top of Test Interval	3.96
Bottom of Test Interval	4.94
Bottom of Lower Packer	5.80

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\ s/m^3$)
1	15:00:30	15:09:00	1680	0.013	2478.35	0.22	1.50	99.40	300.6	22750.2
2	15:09:00	15:14:15	2100	0.017	2469.65	0.28	1.95	98.95	390.1	23617.4
3	15:14:15	15:23:45	2400	0.019	2460.95	0.35	2.40	98.50	479.2	25383.6
4	15:23:45	15:27:15	2100	0.017	2468.64	0.29	2.00	98.90	400.4	24242.7
5	15:27:15	15:30:45	1800	0.014	2477.17	0.23	1.56	99.34	312.9	22096.7

Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.





Packer Test: **220909-B-ANG-4**

Raw Data - Differential Manometer Measurement (mm H_2O)

		Gas Port Number [Measurement Depth (m)]						
	Measurement ID	**1 [1.0]**	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 144	***Initial Reading***	*-0.50*	*0.00*	*-0.25*	*0.50*	*-0.25*	*-0.50*	*-0.50*
	1	-0.50	1.50	1.25	0.75	0.00	-0.50	-0.50
	2	-0.25	1.75	1.50	1.50	0.50	0.25	0.00
	3	0.00	1.75	1.75	1.50	0.50	0.00	0.00
	4	-0.25	1.50	1.25	1.25	0.25	-0.25	-0.25
	5	0.00	1.50	1.25	0.75	0.25	-0.25	-0.25

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	***Initial Reading***	*-0.50*	*-0.50*	*-0.75*	*-0.50*	*-0.50*	*-0.75*
	1	-0.50	-0.50	-0.50	0.00	0.00	0.25
	2	---	---	---	---	---	---
	3	-0.75	-0.75	-0.50	-0.50	-0.75	0.00
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---

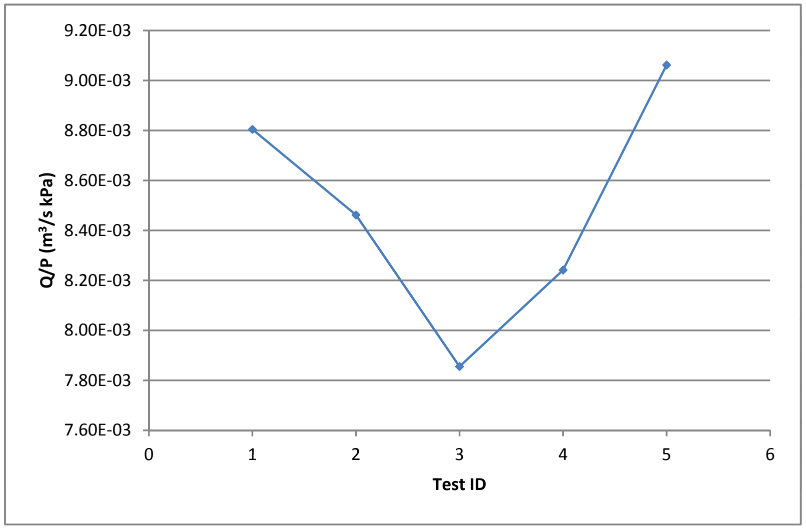
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 143	***Initial Reading***	*-1.00*	*-0.50*	*-1.00*	*-0.50*	*-0.25*	*-0.50*	*-0.50*
	1	-1.00	-0.50	-1.00	-0.25	0.00	-0.25	-0.25
	2	---	---	---	---	---	---	---
	3	-1.00	0.00	-1.00	-0.50	0.00	-0.25	-0.25
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---

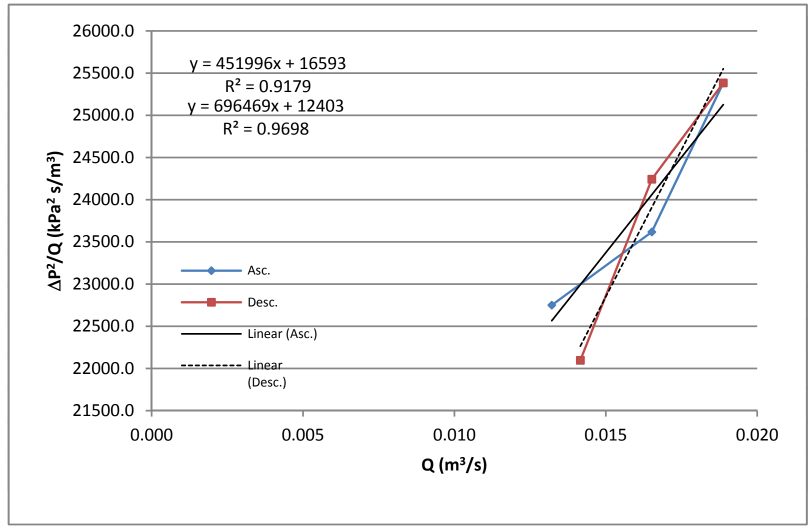
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 144	1	0.00	1.50	1.50	0.25	0.25	0.00	0.00
	2	0.25	1.75	1.75	1.00	0.75	0.75	0.50
	3	0.50	1.75	2.00	1.00	0.75	0.50	0.50
	4	0.25	1.50	1.50	0.75	0.50	0.25	0.25
	5	0.50	1.50	1.50	0.25	0.50	0.25	0.25

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	1	0.00	0.00	0.25	0.50	0.50	1.00
	2	---	---	---	---	---	---
	3	-0.25	-0.25	0.25	0.00	-0.25	0.75
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---

		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 143	1	0.00	0.00	0.00	0.25	0.25	0.25	0.25
	2	---	---	---	---	---	---	---
	3	0.00	0.50	0.00	0.00	0.25	0.25	0.25
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---





Q/P (m^3/s kPa)
8.80E-03
8.46E-03
7.86E-03
8.24E-03
9.06E-03

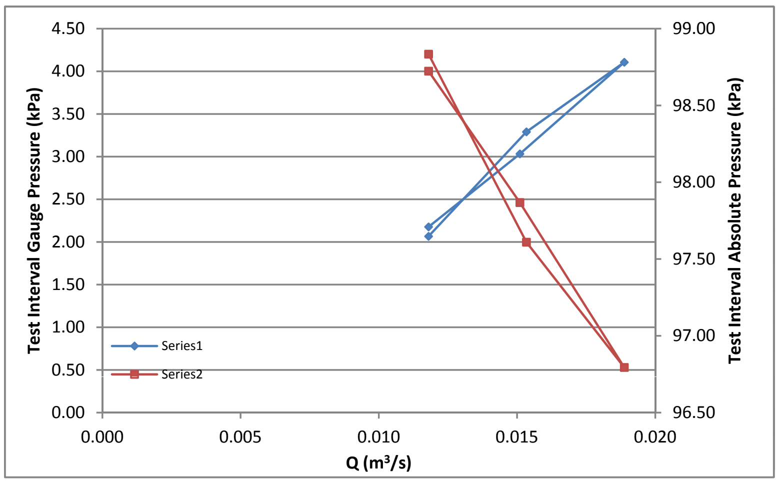
Packer Test:	**220909-B-ANG-5**
Client:	Syncrude Canada Ltd.
Test Date	22-Sep-09
Beginning Time	15:35:45
Ending Time	16:07:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	5.425
Test Interval Temperature	7.3
Ambient Barometric Pressure (kPa)	100.9

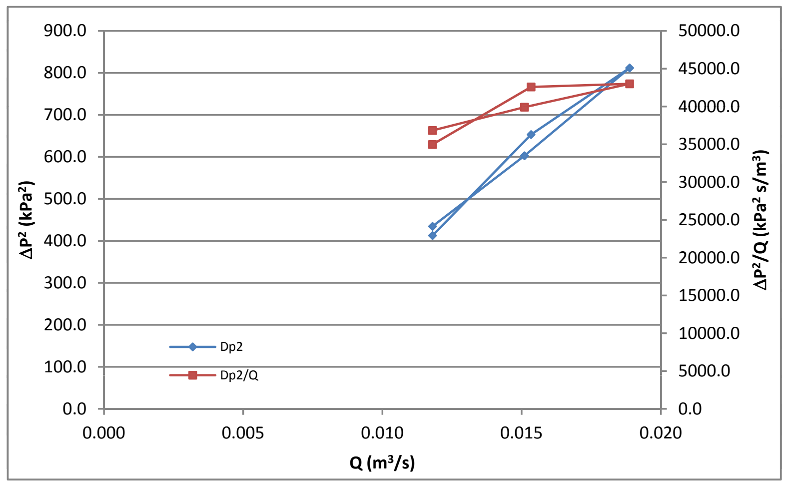
Measurement	**Depth** (m)
Top of Upper Packer	4.08
Top of Test Interval	4.94
Bottom of Test Interval	5.91
Bottom of Lower Packer	6.77

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** (kPa^2 s/m^3)
1	15:38:45	15:46:15	1500	0.012	2467.45	0.30	2.07	98.83	412.7	34974.7
2	15:46:15	15:49:30	1950	0.015	2443.83	0.48	3.29	97.61	653.2	42584.2
3	15:49:30	15:57:15	2400	0.019	2428.10	0.59	4.11	96.79	811.8	43000.3
4	15:57:15	16:01:15	1920	0.015	2448.81	0.44	3.03	97.87	602.7	39908.7
5	16:01:15	16:07:00	1500	0.012	2465.32	0.31	2.18	98.72	434.5	36826.5

Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.





Packer Test: **220909-B-ANG-5**

Raw Data - Differential Manometer Measurement (mm H_2O)

CMT 144

Measurement ID	Gas Port Number [Measurement Depth (m)]						
	1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
Initial Reading	*-0.50*	*0.00*	*-0.25*	*0.50*	*-0.25*	*-0.50*	*-0.50*
1	0.25	0.50	1.25	1.00	0.25	-0.25	-0.25
2	0.75	1.00	1.75	1.50	0.75	-0.25	-0.25
3	0.75	1.50	2.50	2.00	1.50	0.50	0.50
4	0.50	1.00	1.75	1.50	1.00	0.50	0.25
5	0.25	0.50	1.25	1.00	0.50	0.00	-0.25

CMT 147

	1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
Initial Reading	*-0.50*	*-0.50*	*-0.75*	*-0.50*	*-0.50*	*-0.75*
1	-0.25	-0.50	-0.50	0.00	0.25	0.25
2	---	---	---	---	---	---
3	---	---	---	---	---	---
4	---	---	---	---	---	---
5	---	---	---	---	---	---

CMT 143

	1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
Initial Reading	*-1.00*	*-0.50*	*-1.00*	*-0.50*	*-0.25*	*-0.50*	*-0.50*
1	-1.00	-0.25	-1.00	-0.50	-0.25	-1.00	-0.75
2	---	---	---	---	---	---	---
3	---	---	---	---	---	---	
4	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---

Corrected Data - Net Differential Manometer Measurement (mm H_2O)

CMT 144

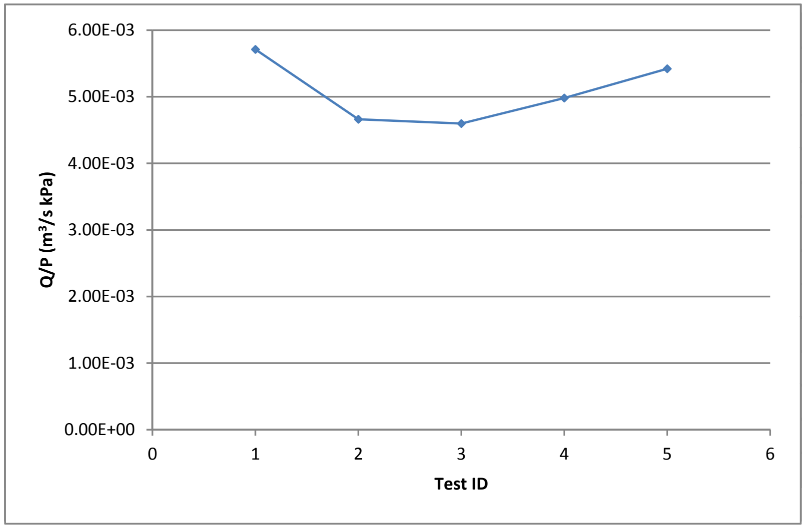
Measurement ID	Gas Port Number [Measurement Depth (m)]						
	1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
1	0.75	0.50	1.50	0.50	0.50	0.25	0.25
2	1.25	1.00	2.00	1.00	1.00	0.25	0.25
3	1.25	1.50	2.75	1.50	1.75	1.00	1.00
4	1.00	1.00	2.00	1.00	1.25	1.00	0.75
5	0.75	0.50	1.50	0.50	0.75	0.50	0.25

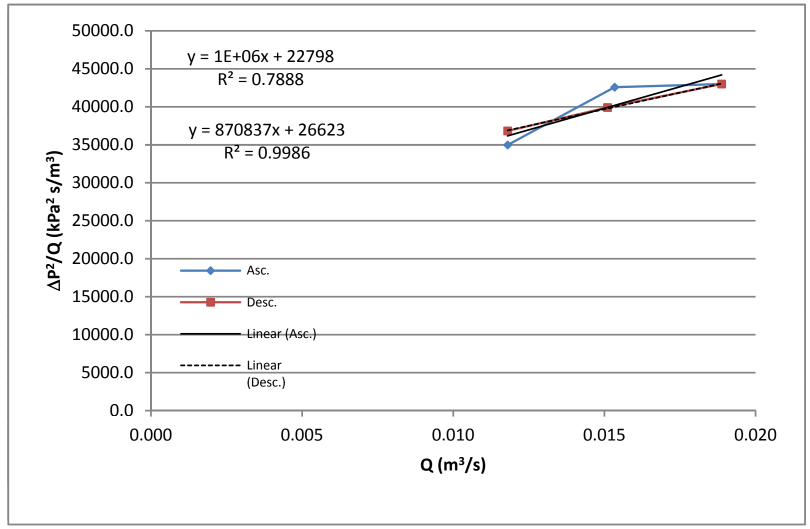
CMT 147

	1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
1	0.25	0.00	0.25	0.50	0.75	1.00
2	---	---	---	---	---	---
3	---	---	---	---	---	---
4	---	---	---	---	---	---
5	---	---	---	---	---	---

CMT 143

	1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
1	0.00	0.25	0.00	0.00	0.00	-0.50	-0.25
2	---	---	---	---	---	---	---
3	---	---	---	---	---	---	
4	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---





Q/P (m^3/s kPa)
5.71E-03
4.66E-03
4.60E-03
4.98E-03
5.42E-03

Packer Test: **220909-B-ANG-6**

Client: Syncrude Canada Ltd.

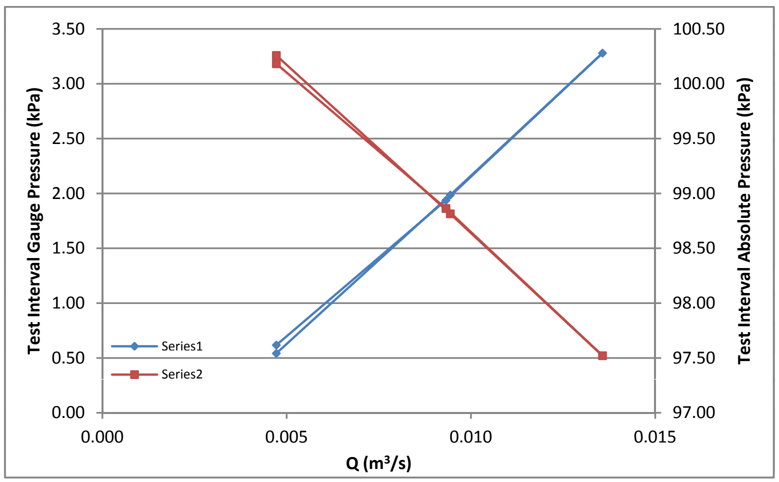
Test Date	22-Sep-09
Beginning Time	16:56:30
Ending Time	17:35:30
Test Interval Length (m)	1.38
Center of Test Interval (m)	6.4
Test Interval Temperature	8.1
Ambient Barometric Pressure (kPa)	100.8

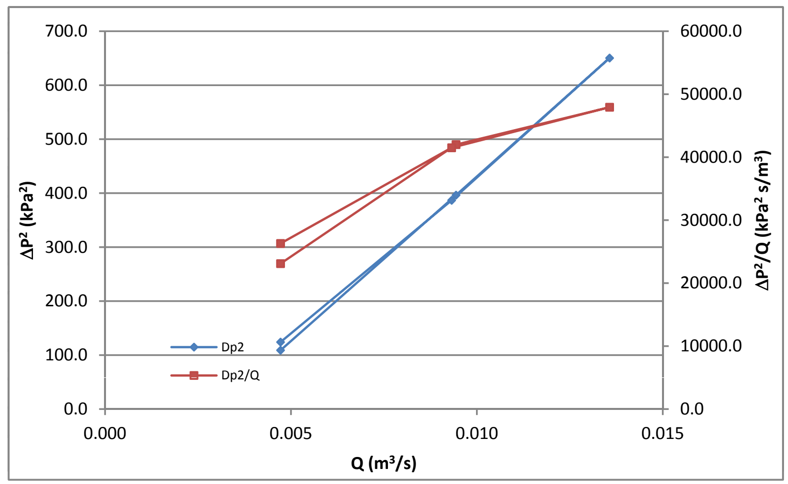
Measurement	**Depth** (m)
Top of Upper Packer	5.05
Top of Test Interval	5.91
Bottom of Test Interval	6.89
Bottom of Lower Packer	7.75

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2 s/m^3$)
1	17:00:45	17:09:00	600	0.005	2496.85	0.08	0.54	100.26	109.0	23096.1
2	17:09:00	17:12:30	1200	0.009	2469.00	0.29	1.99	98.81	396.4	41994.7
3	17:12:30	17:23:00	1725	0.014	2444.05	0.47	3.28	97.52	650.3	47929.6
4	17:23:00	17:27:15	1185	0.009	2469.94	0.28	1.94	98.86	386.8	41495.7
5	17:27:15	17:35:30	600	0.005	2495.39	0.09	0.62	100.18	124.1	26298.5

Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.





Packer Test: **220909-B-ANG-6**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)] 1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
CMT 144	***Initial Reading***	*-0.50*	*0.00*	*-0.25*	*0.50*	*-0.25*	*-0.50*	*-0.50*
	1	0.00	0.25	0.50	1.00	0.50	0.25	0.00
	2	0.00	0.50	1.00	1.50	1.00	0.75	0.50
	3	0.25	0.75	1.25	1.75	1.00	0.75	0.75
	4	0.00	0.50	1.00	1.50	0.75	0.50	0.25
	5	-0.25	0.00	0.50	1.00	0.00	-0.25	-0.25

		1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
CMT 147	***Initial Reading***	*-0.50*	*-0.50*	*-0.75*	*-0.50*	*-0.50*	*-0.75*
	1	-0.50	-0.50	-0.50	0.00	0.00	0.50
	2	---	---	---	---	---	---
	3	-0.50	-0.50	-0.50	0.00	0.00	0.50
	4	---	---	---	---	---	---
	5	-0.50	-0.50	-0.50	0.00	0.00	0.25

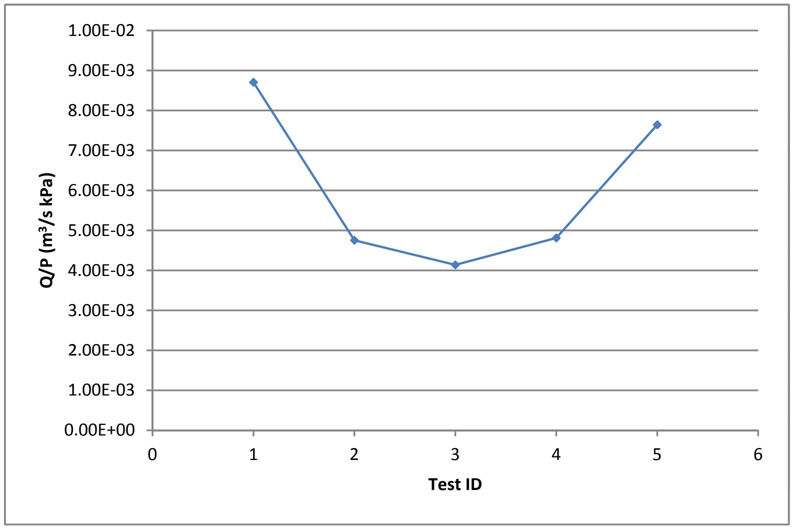
		1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
CMT 143	***Initial Reading***	*-1.00*	*-0.50*	*-1.00*	*-0.50*	*-0.25*	*-0.50*	*-0.50*
	1	-1.00	-0.50	-1.00	-0.50	-0.25	-0.50	-0.50
	2	---	---	---	---	---	---	---
	3	-1.00	-0.50	-0.75	-0.25	-0.25	-0.50	-0.50
	4	---	---	---	---	---	---	---
	5	-1.00	-0.50	-1.00	-0.50	0.00	-0.50	*-0.50*

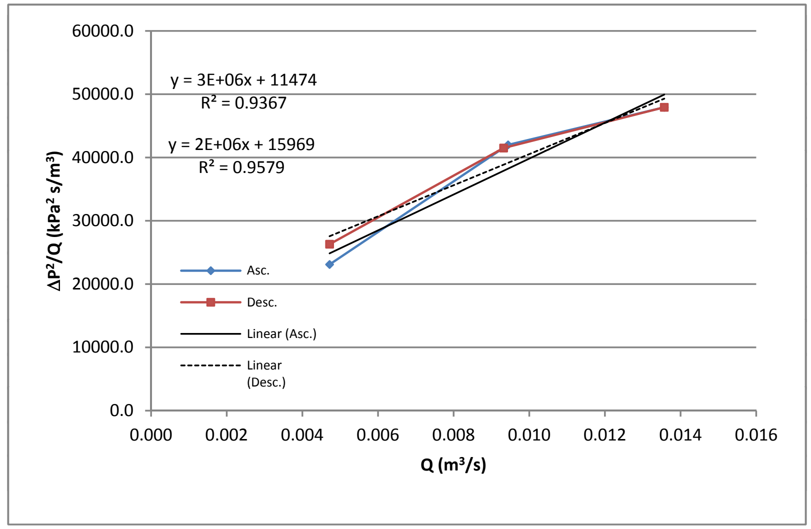
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)] 1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
CMT 144	1	0.50	0.25	0.75	0.50	0.75	0.75	0.50
	2	0.50	0.50	1.25	1.00	1.25	1.25	1.00
	3	0.75	0.75	1.50	1.25	1.25	1.25	1.25
	4	0.50	0.50	1.25	1.00	1.00	1.00	0.75
	5	0.25	0.00	0.75	0.50	0.25	0.25	0.25

		1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
CMT 147	1	0.00	0.00	0.25	0.50	0.50	1.25
	2	---	---	---	---	---	---
	3	0.00	0.00	0.25	0.50	0.50	1.25
	4	---	---	---	---	---	---
	5	0.00	0.00	0.25	0.50	0.50	1.00

		1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
CMT 143	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2	---	---	---	---	---	---	---
	3	0.00	0.00	0.25	0.25	0.00	0.00	0.00
	4	---	---	---	---	---	---	---
	5	0.00	0.00	0.00	0.00	0.25	0.00	0.00





Q/P (m^3/s kPa)
8.71E-03
4.75E-03
4.14E-03
4.81E-03
7.64E-03

Packer Test:	**220909-B-ANG-7**
Client:	Syncrude Canada Ltd.

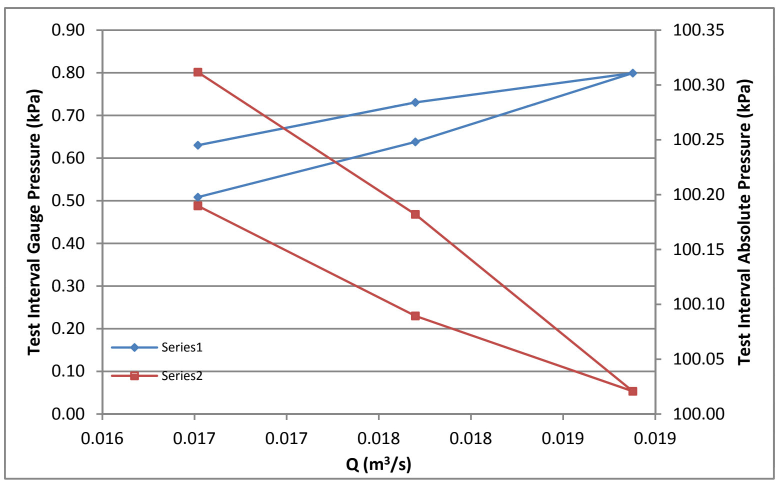
Test Date	22-Sep-09
Beginning Time	17:40:15
Ending Time	18:05:30
Test Interval Length (m)	1.38
Center of Test Interval (m)	7.375
Test Interval Temperature	8.5
Ambient Barometric Pressure (kPa)	100.8

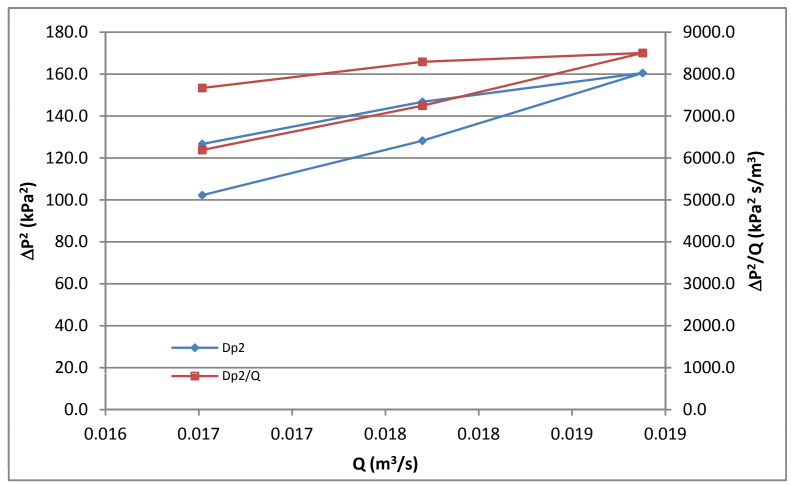
Measurement	**Depth** (m)
Top of Upper Packer	6.03
Top of Test Interval	6.89
Bottom of Test Interval	7.86
Bottom of Lower Packer	8.72

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** (kPa^2 s/m^3)
1	17:44:45	17:49:45	2100	0.017	2495.15	0.09	0.63	100.19	126.7	7668.8
2	17:49:45	17:53:15	2250	0.018	2493.21	0.11	0.73	100.09	146.8	8293.0
3	17:53:15	17:57:45	2400	0.019	2491.89	0.12	0.80	100.02	160.5	8503.0
4	17:57:45	18:00:00	2250	0.018	2495.00	0.09	0.64	100.18	128.2	7245.5
5	18:00:00	18:02:15	2100	0.017	2497.50	0.07	0.51	100.31	102.2	6190.1

Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.





Packer Test: **220909-B-ANG-7**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
CMT 144	*Initial Reading*	*-0.50*	*0.00*	*-0.25*	*0.50*	*-0.25*	*-0.50*	*-0.50*
	1	0.00	0.50	1.00	2.00	1.00	1.00	0.75
	2	0.00	0.75	1.25	2.25	1.25	1.50	0.75
	3	0.00	1.00	1.50	2.50	1.50	1.00	0.75
	4	0.00	0.75	1.00	2.25	1.25	0.75	0.75
	5	0.00	0.50	1.25	2.25	1.00	0.75	0.75

		1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
CMT 147	*Initial Reading*	*-0.50*	*-0.50*	*-0.75*	*-0.50*	*-0.50*	*-0.75*
	1	-1.00	-0.50	-1.00	-0.50	0.25	-0.50
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---

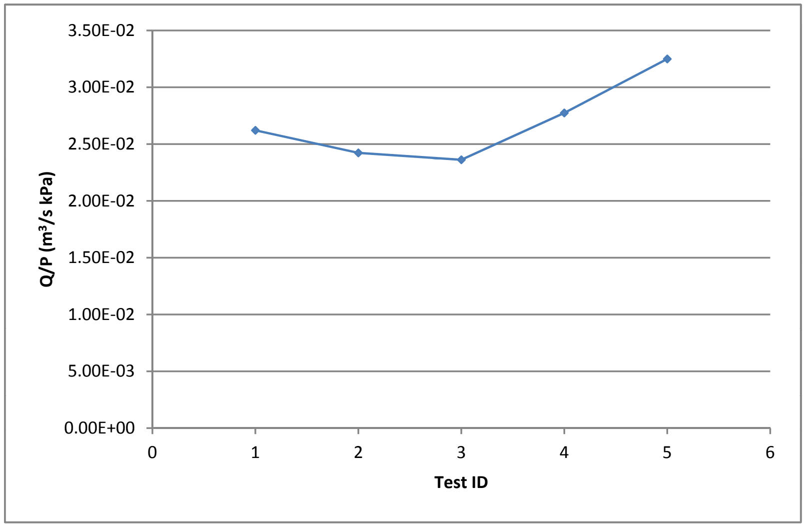
		1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
CMT 143	*Initial Reading*	*-1.00*	*-0.50*	*-1.00*	*-0.50*	*-0.25*	*-0.50*	*-0.50*
	1	---	---	---	---	---	---	---
	2	---	---	---	---	---	---	---
	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---

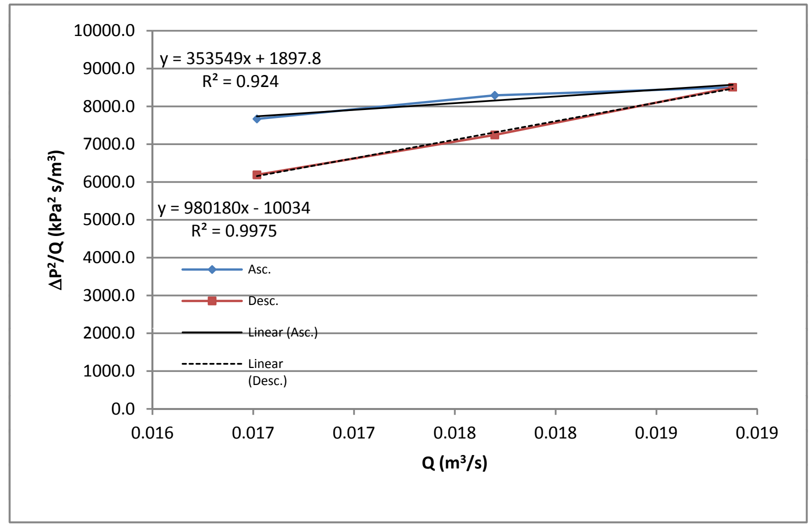
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
CMT 144	1	0.50	0.50	1.25	1.50	1.25	1.50	1.25
	2	0.50	0.75	1.50	1.75	1.50	2.00	1.25
	3	0.50	1.00	1.75	2.00	1.75	1.50	1.25
	4	0.50	0.75	1.25	1.75	1.50	1.25	1.25
	5	0.50	0.50	1.50	1.75	1.25	1.25	1.25

		1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
CMT 147	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---

		1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
CMT 143	1	---	---	---	---	---	---	---
	2	---	---	---	---	---	---	---
	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---





Q/P (m^3/s kPa)
2.62E-02
2.42E-02
2.36E-02
2.77E-02
3.25E-02

Packer Test: **220909-B-ANG-8**

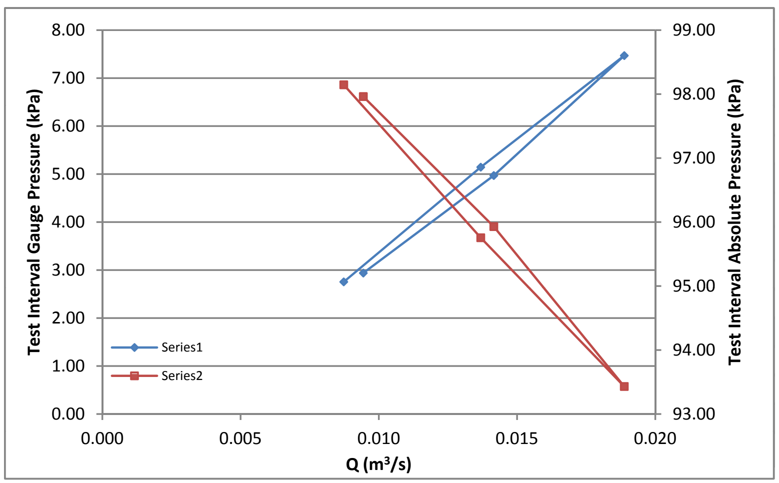
Client:	Syncrude Canada Ltd.
Test Date	22-Sep-09
Beginning Time	18:10:00
Ending Time	18:36:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	8.35
Test Interval Temperature	8.6
Ambient Barometric Pressure (kPa)	100.9

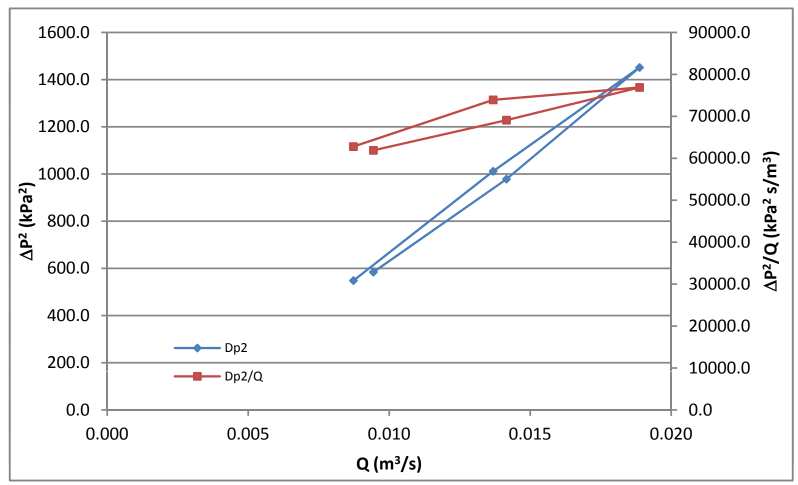
Measurement	**Depth** (m)
Top of Upper Packer	7.00
Top of Test Interval	7.86
Bottom of Test Interval	8.84
Bottom of Lower Packer	9.70

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\ s/m^3$)
1	18:14:15	18:18:30	1110	0.009	2454.18	0.40	2.75	98.15	548.2	62788.7
2	18:18:30	18:22:15	1740	0.014	2408.07	0.74	5.14	95.76	1011.7	73918.6
3	18:22:15	18:27:15	2400	0.019	2363.22	1.08	7.47	93.43	1451.5	76887.8
4	18:27:15	18:31:00	1800	0.014	2411.43	0.72	4.97	95.93	978.3	69095.1
5	18:31:00	18:36:00	1200	0.009	2450.63	0.43	2.94	97.96	584.2	61897.5

Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.





Packer Test: **220909-B-ANG-8**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)] 1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
	Initial Reading	*-0.50*	*0.00*	*-0.25*	*0.50*	*-0.25*	*-0.50*	*-0.50*
CMT 144	**1**	0.00	0.25	0.50	1.50	0.75	0.00	0.00
	2	0.00	0.50	0.75	2.00	1.00	0.50	0.50
	3	0.00	0.75	1.00	2.25	1.50	0.75	0.75
	4	0.00	0.50	1.00	2.00	1.00	0.75	0.50
	5	0.00	0.00	0.50	1.75	0.75	0.25	0.25

		1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
	Initial Reading	*-0.50*	*-0.50*	*-0.75*	*-0.50*	*-0.50*	*-0.75*
CMT 147	**1**	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---

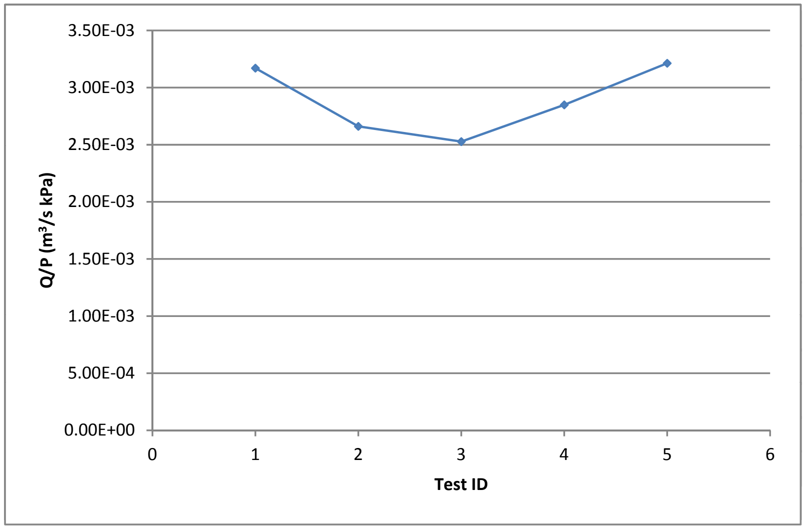
		1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
	Initial Reading	*-1.00*	*-0.50*	*-1.00*	*-0.50*	*-0.25*	*-0.50*	*-0.50*
CMT 143	**1**	---	---	---	---	---	---	---
	2	---	---	---	---	---	---	---
	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---

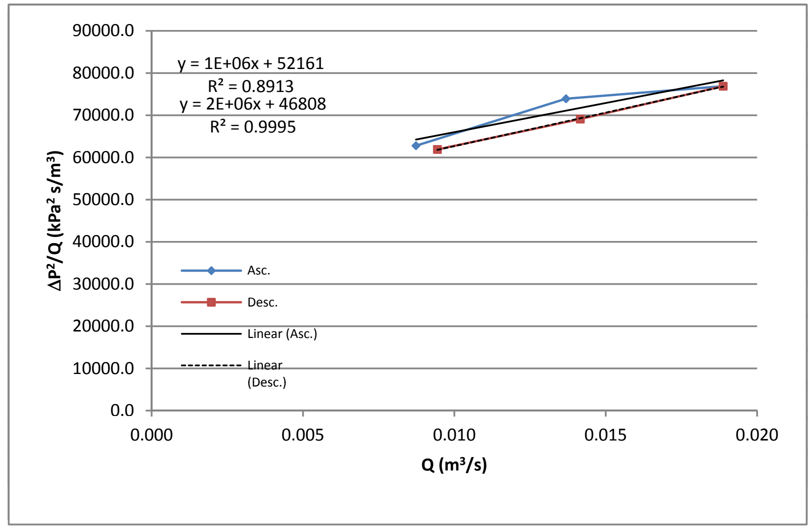
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)] 1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
CMT 144	1	0.50	0.25	0.75	1.00	1.00	0.50	0.50
	2	0.50	0.50	1.00	1.50	1.25	1.00	1.00
	3	0.50	0.75	1.25	1.75	1.75	1.25	1.25
	4	0.50	0.50	1.25	1.50	1.25	1.25	1.00
	5	0.50	0.00	0.75	1.25	1.00	0.75	0.75

		1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
CMT 147	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---

		1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
CMT 143	1	---	---	---	---	---	---	---
	2	---	---	---	---	---	---	---
	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---





Q/P (m^3/s kPa)
3.17E-03
2.66E-03
2.53E-03
2.85E-03
3.21E-03

Packer Test:	**240909-B-ANG-1**
Client:	Syncrude Canada Ltd.

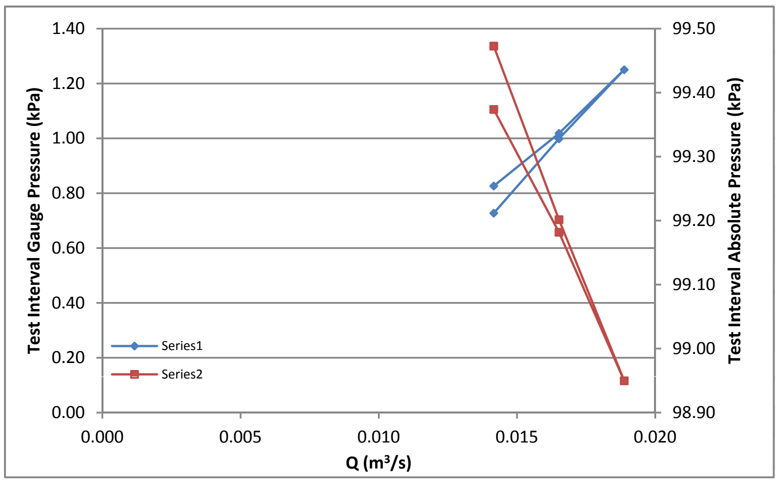
Test Date	24-Sep-09
Beginning Time	11:05:45
Ending Time	11:34:30
Test Interval Length (m)	1.38
Center of Test Interval (m)	9.325
Test Interval Temperature	11.1
Ambient Barometric Pressure (kPa)	100.2

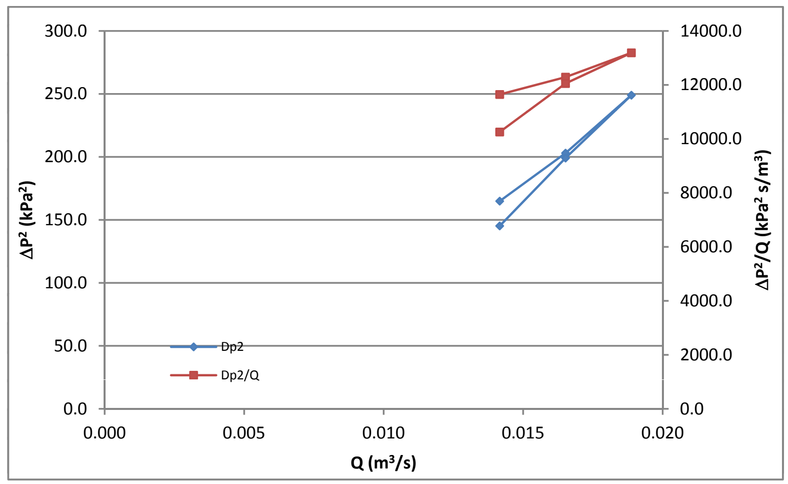
Measurement	**Depth** (m)
Top of Upper Packer	7.98
Top of Test Interval	8.84
Bottom of Test Interval	9.81
Bottom of Lower Packer	10.67

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\,s/m^3$)
1	11:08:15	11:13:00	1800	0.014	2491.37	0.12	0.83	99.37	164.9	11646.2
2	11:13:00	11:19:00	2100	0.017	2487.67	0.15	1.02	99.18	203.0	12289.1
3	11:19:00	11:23:00	2400	0.019	2483.19	0.18	1.25	98.95	249.0	13189.9
4	11:23:00	11:28:30	2100	0.017	2488.05	0.14	1.00	99.20	199.1	12053.2
5	11:28:30	11:32:45	1800	0.014	2493.28	0.11	0.73	99.47	145.2	10256.1

Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.





Packer Test: **240909-B-ANG-1**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 144	***Initial Reading***	---	---	---	---	---	---	---
	1	---	---	---	---	---	---	---
	2	---	---	---	---	---	---	---
	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	***Initial Reading***	---	---	---	---	---	---
	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---

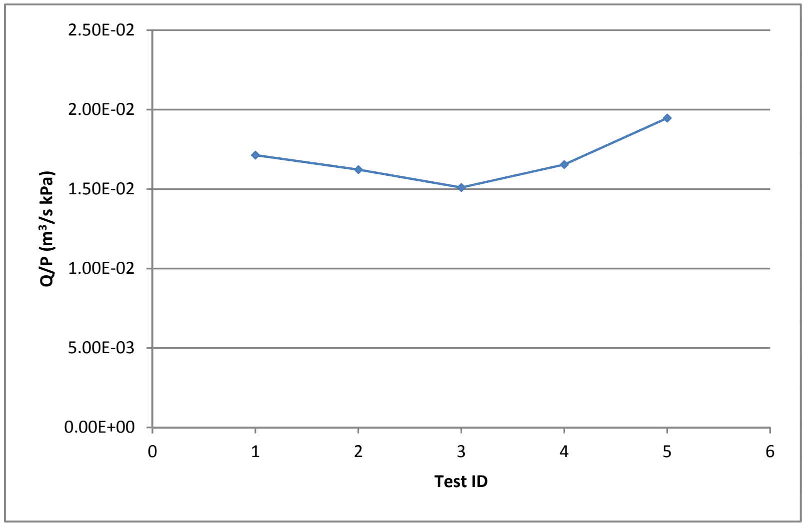
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 143	***Initial Reading***	---	---	---	---	---	---	---
	1	---	---	---	---	---	---	---
	2	---	---	---	---	---	---	---
	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---

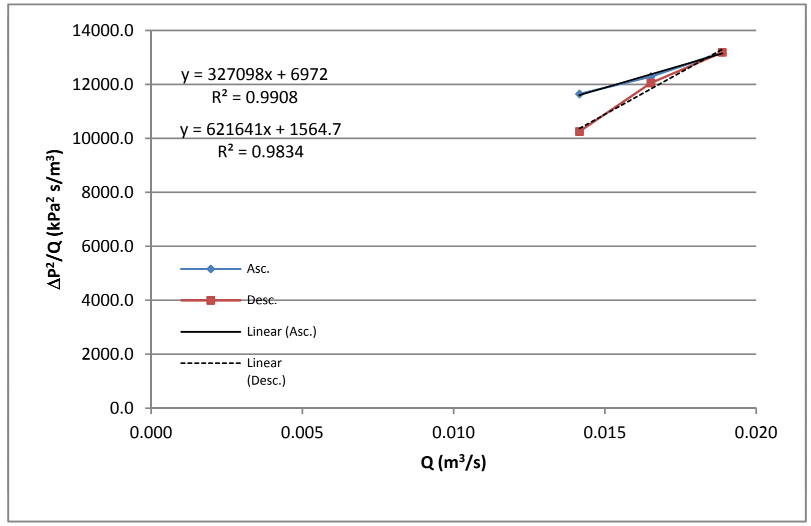
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 144	1	---	---	---	---	---	---	---
	2	---	---	---	---	---	---	---
	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---

		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 143	1	---	---	---	---	---	---	---
	2	---	---	---	---	---	---	---
	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---





Q/P (m^3/s kPa)
1.71E-02
1.62E-02
1.51E-02
1.65E-02
1.95E-02

Packer Test:	**240909-B-ANG-2**
Client:	Syncrude Canada Ltd.

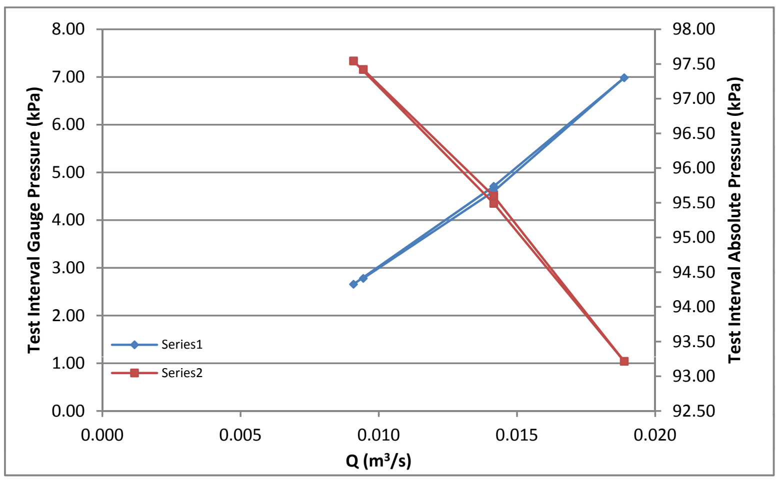
Test Date	24-Sep-09
Beginning Time	11:37:30
Ending Time	12:09:45
Test Interval Length (m)	1.38
Center of Test Interval (m)	10.3
Test Interval Temperature	10.3
Ambient Barometric Pressure (kPa)	100.2

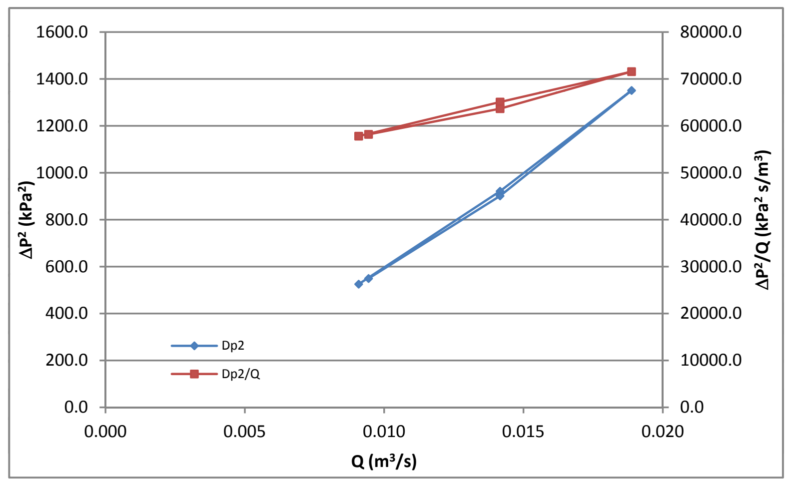
Measurement	**Depth** (m)
Top of Upper Packer	8.95
Top of Test Interval	9.81
Bottom of Test Interval	10.79
Bottom of Lower Packer	11.65

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\ s/m^3$)
1	11:41:30	11:52:00	1155	0.009	2456.07	0.38	2.66	97.54	525.2	57809.6
2	11:52:00	11:56:45	1800	0.014	2416.47	0.68	4.71	95.49	921.4	65080.7
3	11:56:45	12:00:15	2400	0.019	2372.57	1.01	6.98	93.22	1350.9	71560.1
4	12:00:15	12:04:00	1800	0.014	2418.50	0.67	4.60	95.60	901.4	63663.1
5	12:04:00	12:07:00	1200	0.009	2453.69	0.40	2.78	97.42	549.2	58189.2

Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.





Packer Test: **240909-B-ANG-2**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 144	***Initial Reading***	---	---	---	---	---	---	---
	1	---	---	---	---	---	---	---
	2	---	---	---	---	---	---	---
	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	***Initial Reading***	---	---	---	---	---	---
	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---

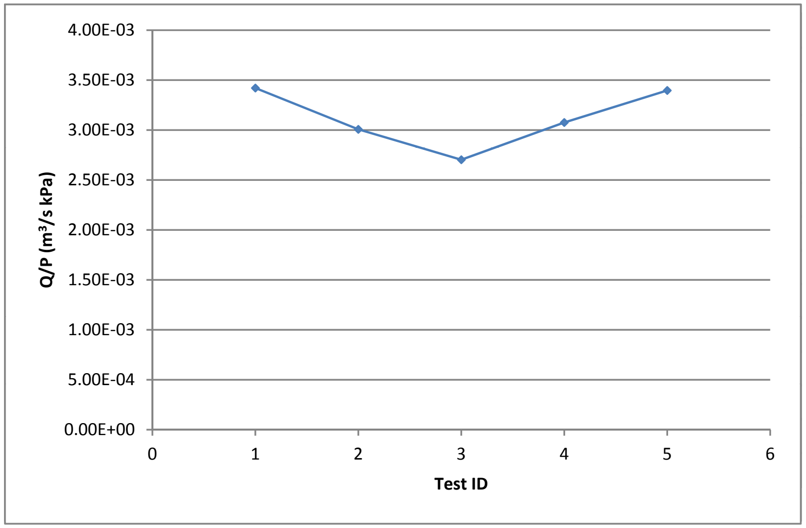
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 143	***Initial Reading***	---	---	---	---	---	---	---
	1	---	---	---	---	---	---	---
	2	---	---	---	---	---	---	---
	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---

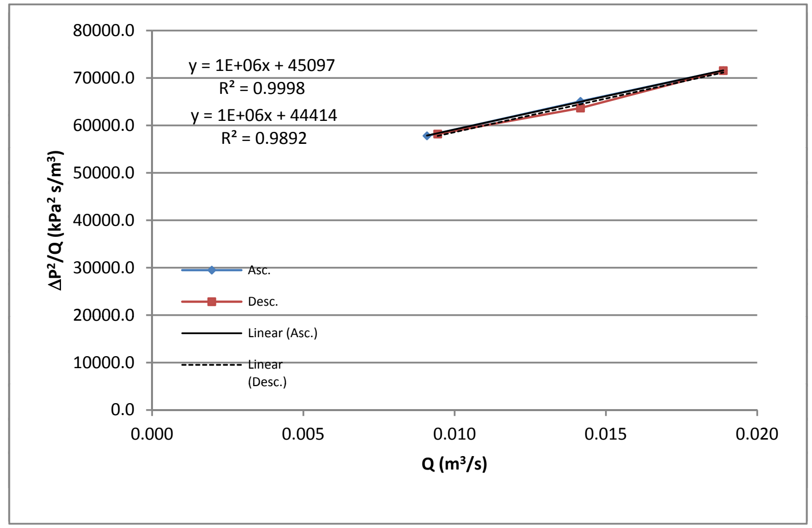
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 144	1	---	---	---	---	---	---	---
	2	---	---	---	---	---	---	---
	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---

		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 143	1	---	---	---	---	---	---	---
	2	---	---	---	---	---	---	---
	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---





Q/P (m^3/s kPa)
3.42E-03
3.01E-03
2.70E-03
3.08E-03
3.40E-03

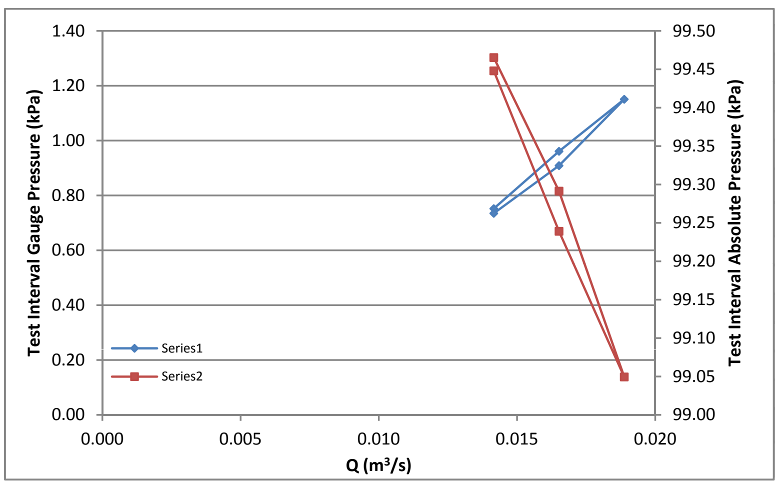
Packer Test:	**240909-B-ANG-3**
Client:	Syncrude Canada Ltd.
Test Date	24-Sep-09
Beginning Time	12:13:00
Ending Time	12:29:30
Test Interval Length (m)	1.38
Center of Test Interval (m)	11.21
Test Interval Temperature	10.4
Ambient Barometric Pressure (kPa)	100.2

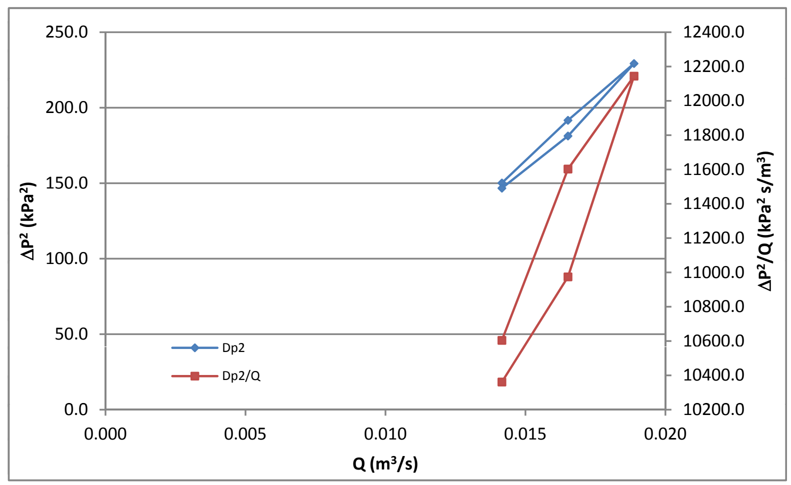
Measurement	**Depth** (m)
Top of Upper Packer	9.86
Top of Test Interval	10.72
Bottom of Test Interval	11.70
Bottom of Lower Packer	12.56

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\ s/m^3$)
1	12:15:15	12:17:45	1800	0.014	2492.80	0.11	0.75	99.45	150.1	10604.1
2	12:17:45	12:21:15	2100	0.017	2488.77	0.14	0.96	99.24	191.7	11602.5
3	12:21:15	12:23:30	2400	0.019	2485.11	0.17	1.15	99.05	229.3	12144.0
4	12:23:30	12:25:45	2100	0.017	2489.78	0.13	0.91	99.29	181.3	10974.1
5	12:25:45	12:29:30	1800	0.014	2493.13	0.11	0.73	99.47	146.7	10361.3

Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.





Packer Test: **240909-B-ANG-3**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
		Gas Port Number [Measurement Depth (m)]						
CMT 144	*Initial Reading*	---	---	---	---	---	---	---
	1	---	---	---	---	---	---	---
	2	---	---	---	---	---	---	---
	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---

		1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
CMT 147	*Initial Reading*	---	---	---	---	---	---
	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---

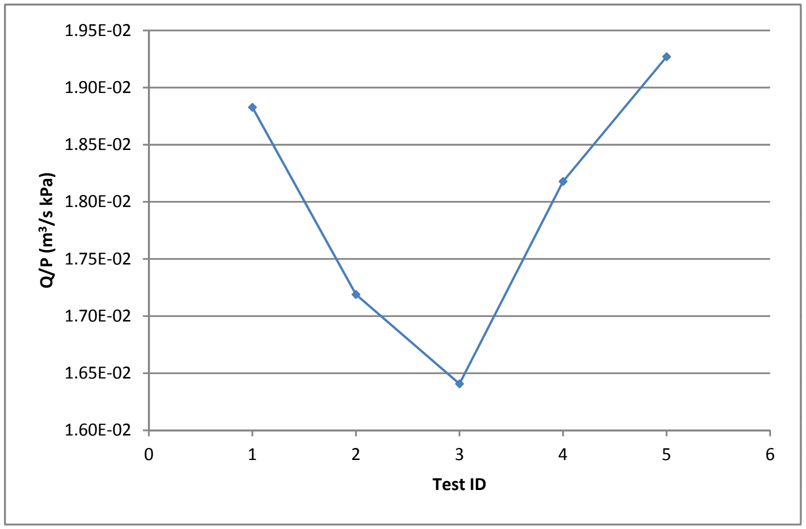
		1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
CMT 143	*Initial Reading*	---	---	---	---	---	---	---
	1	---	---	---	---	---	---	---
	2	---	---	---	---	---	---	---
	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---

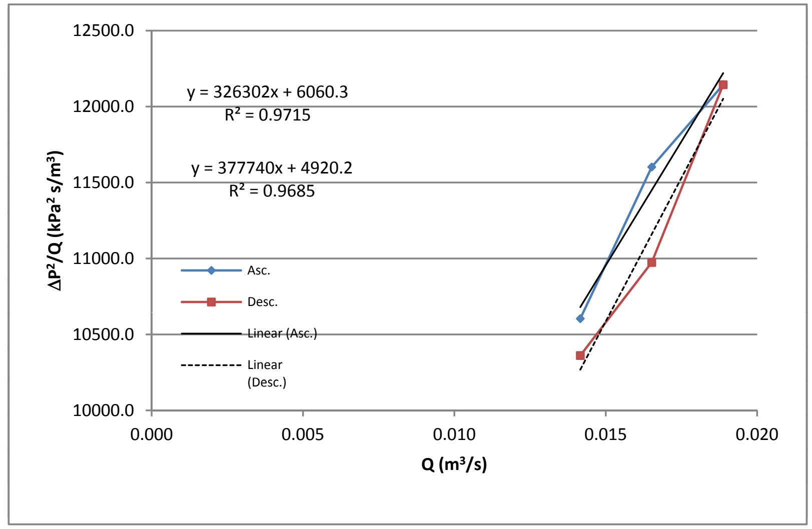
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
		Gas Port Number [Measurement Depth (m)]						
CMT 144	1	---	---	---	---	---	---	---
	2	---	---	---	---	---	---	---
	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---

		1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
CMT 147	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---

		1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
CMT 143	1	---	---	---	---	---	---	---
	2	---	---	---	---	---	---	---
	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---



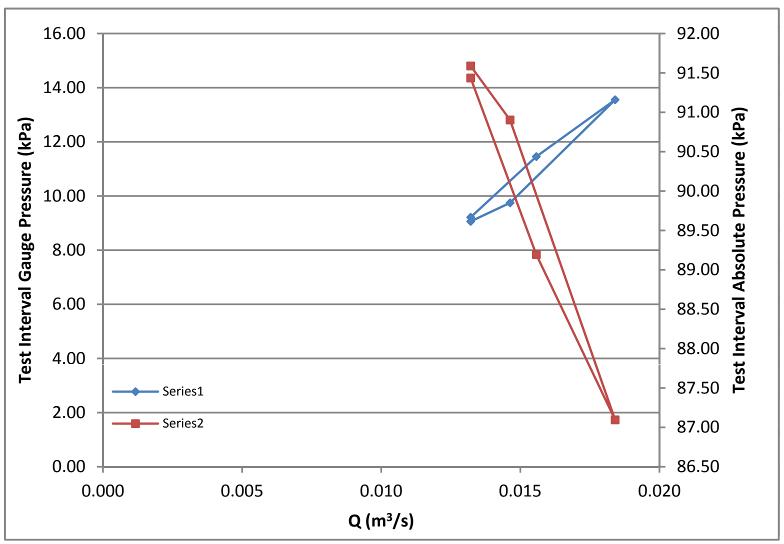


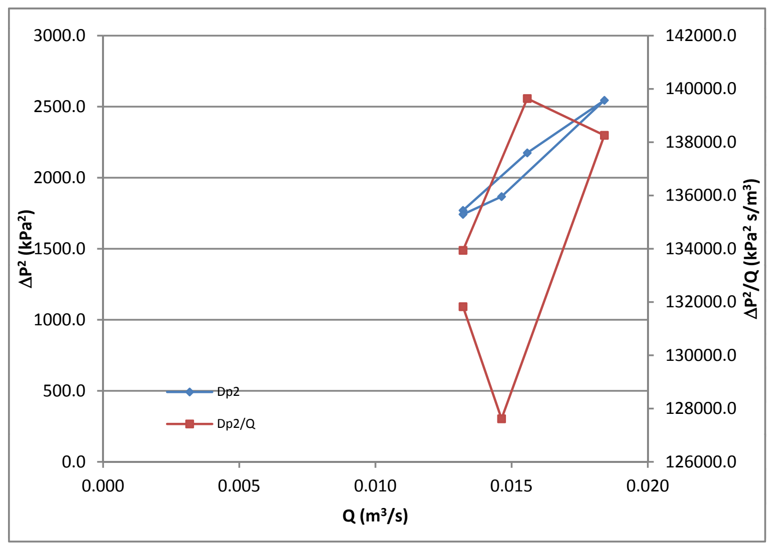
Q/P (m^3/s kPa)
1.88E-02
1.72E-02
1.64E-02
1.82E-02
1.93E-02

Packer Test:	**090909-C-VERT-1**
Client:	Syncrude Canada Ltd.
Test Date	9-Sep-09
Beginning Time	17:08:00
Ending Time	17:54:30
Test Interval Length (m)	1.38
Center of Test Interval (m)	1.8
Test Interval Temperature	13.4
Ambient Barometric Pressure (kPa	100.7

Measurement	**Depth** (m)
Top of Upper Packer	0.25
Top of Test Interval	1.11
Bottom of Test Interval	2.49
Bottom of Lower Packer	3.35

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** (kPa^2 s/m^3)
1	17:11:15	17:26:45	1680	0.013	2329.56	1.33	9.21	91.44	1769.9	133939.2
2	17:29:00	17:36:15	1980	0.016	2286.32	1.66	11.46	89.19	2174.8	139638.6
3	17:36:15	17:46:15	2340	0.018	2245.83	1.96	13.55	87.10	2544.8	138258.2
4	17:46:15	17:51:15	1860	0.015	2319.28	1.41	9.75	90.90	1867.1	127617.4
5	17:51:15	17:54:30	1680	0.013	2332.50	1.31	9.06	91.59	1742.0	131825.1





Packer Test: **090909-C-VERT-1**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
CMT 145	*Initial Reading*	*0.50*	*0.50*	*1.00*	*0.50*	*0.50*	*0.00*	*0.00*
	1	2.00	1.00	0.50	1.00	1.75	0.00	0.00
	2	2.00	1.00	1.00	1.00	1.00	0.00	0.00
	3	2.00	2.00	1.00	1.75	1.00	0.00	0.00
	4	1.75	1.50	1.00	1.00	1.00	-0.50	0.00
	5	1.50	1.25	1.00	1.00	1.00	0.00	0.00

		1 [2.0]	2 [4.0]	3 [6.0]	4 [8.0]	5 [12.0]	6 [14.0]	7 [16.0]
CMT 146	*Initial Reading*	---	---	---	---	---	---	---
	1	---	---	---	---	---	---	---
	2	---	---	---	---	---	---	---
	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---

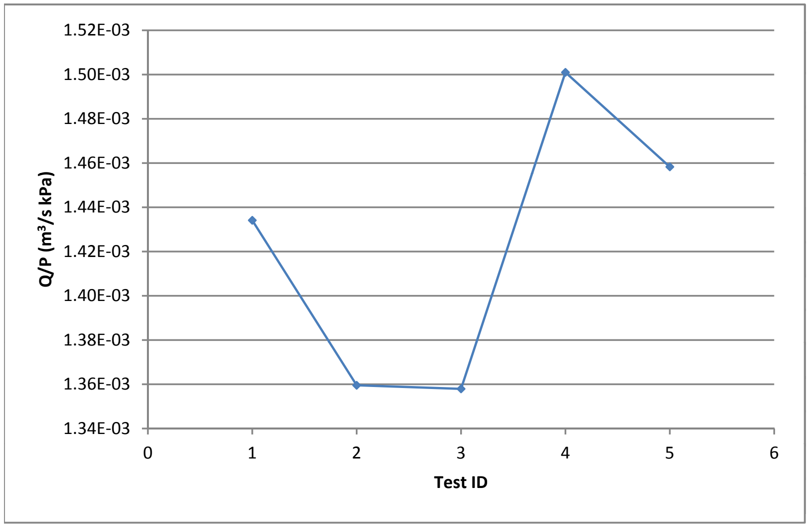
		1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
CMT 147	*Initial Reading*	---	---	---	---	---	---
	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---

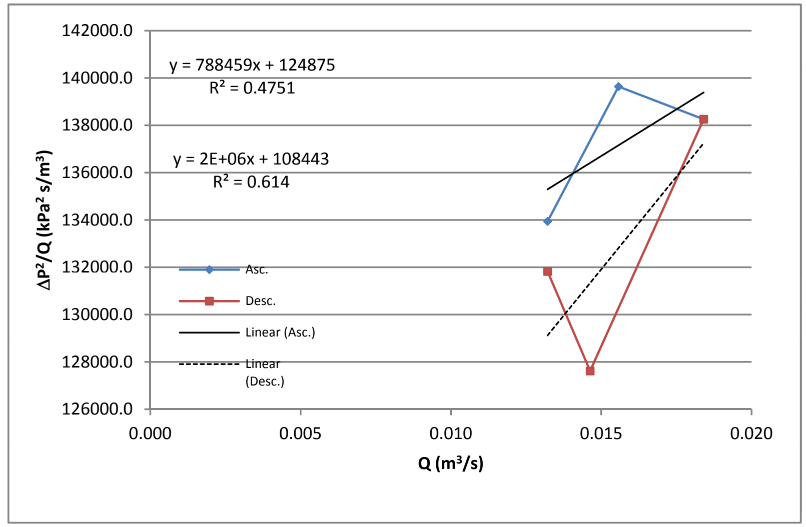
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
CMT 145	1	1.50	0.50	-0.50	0.50	1.25	0.00	0.00
	2	1.50	0.50	0.00	0.50	0.50	0.00	0.00
	3	1.50	1.50	0.00	1.25	0.50	0.00	0.00
	4	1.25	1.00	0.00	0.50	0.50	-0.50	0.00
	5	1.00	0.75	0.00	0.50	0.50	0.00	0.00

		1 [2.0]	2 [4.0]	3 [6.0]	4 [8.0]	5 [12.0]	6 [14.0]	7 [16.0]
CMT 146	1	---	---	---	---	---	---	---
	2	---	---	---	---	---	---	---
	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---

		1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
CMT 147	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---





Q/P (m^3/s kPa)
1.43E-03
1.36E-03
1.36E-03
1.50E-03
1.46E-03

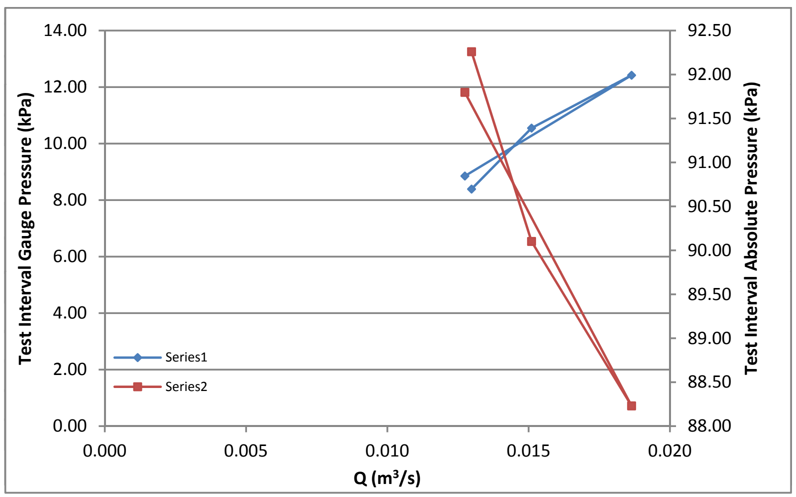
Packer Test: **090909-C-VERT-2**

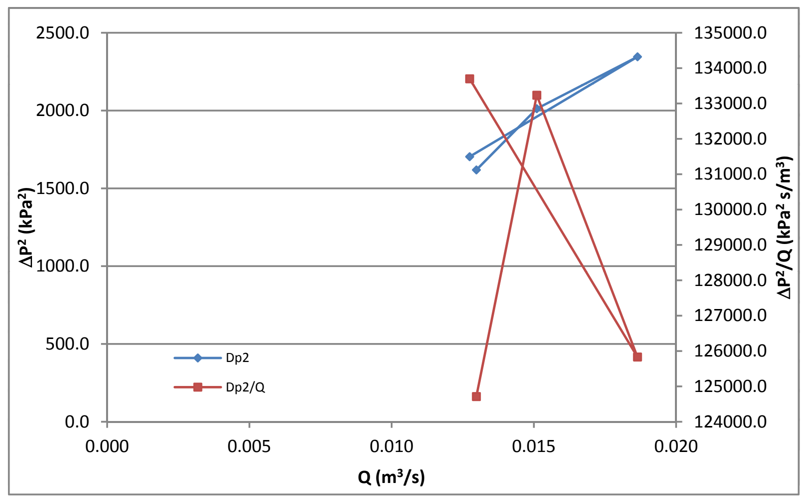
Client: Syncrude Canada Ltd.

Test Date	9-Sep-09
Beginning Time	18:07:45
Ending Time	18:30:15
Test Interval Length (m)	1.38
Center of Test Interval (m)	1.8
Test Interval Temperature	13.0
Ambient Barometric Pressure (kPa)	100.7

Measurement	**Depth** (m)
Top of Upper Packer	0.25
Top of Test Interval	1.11
Bottom of Test Interval	2.49
Bottom of Lower Packer	3.35

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\,s/m^3$)
1	18:09:45	18:15:15	1650	0.013	2345.45	1.21	8.39	92.26	1618.6	124712.5
2	18:15:15	18:18:00	1920	0.015	2303.82	1.53	10.55	90.10	2012.1	133234.3
3	18:22:30	18:26:00	2370	0.019	2267.73	1.80	12.42	88.23	2345.7	125831.0
4	18:26:30	18:30:15	1620	0.013	2336.53	1.28	8.85	91.80	1703.7	133698.5
5	---	---	---	---	---	---	---	---	---	---





Packer Test: **090909-C-VERT-2**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
CMT 145	*Initial Reading*	*-0.50*	*0.50*	*1.00*	*0.50*	*0.50*	*0.00*	*0.00*
	1	1.00	1.00	0.50	1.00	1.00	0.00	0.00
	2	1.75	1.00	1.00	1.25	1.25	0.00	0.00
	3	2.00	1.50	1.00	1.00	1.50	0.00	0.00
	4	1.75	1.75	1.00	1.25	1.50	0.00	0.00
	5	---	---	---	---	---	---	---

		1 [2.0]	2 [4.0]	3 [6.0]	4 [8.0]	5 [12.0]	6 [14.0]	7 [16.0]
CMT 146	*Initial Reading*	---	---	---	---	---	---	---
	1	---	---	---	---	---	---	---
	2	---	---	---	---	---	---	---
	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---

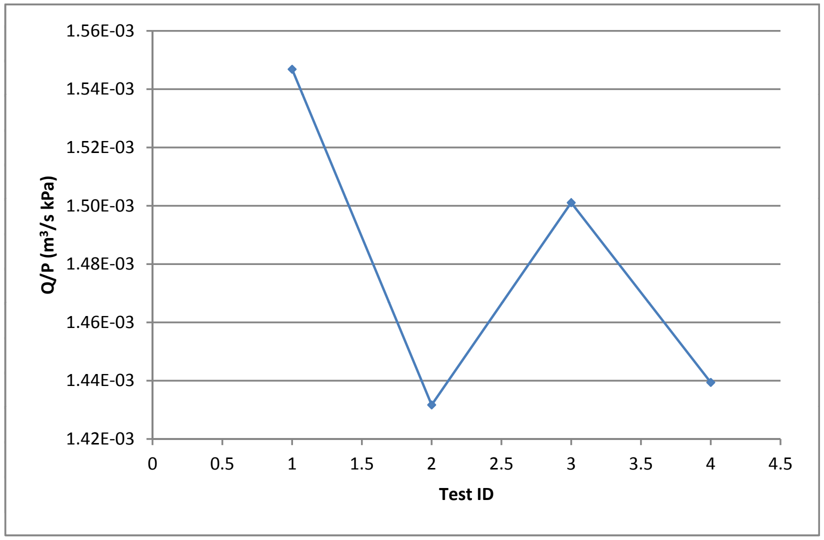
		1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
CMT 147	*Initial Reading*	---	---	---	---	---	---
	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---

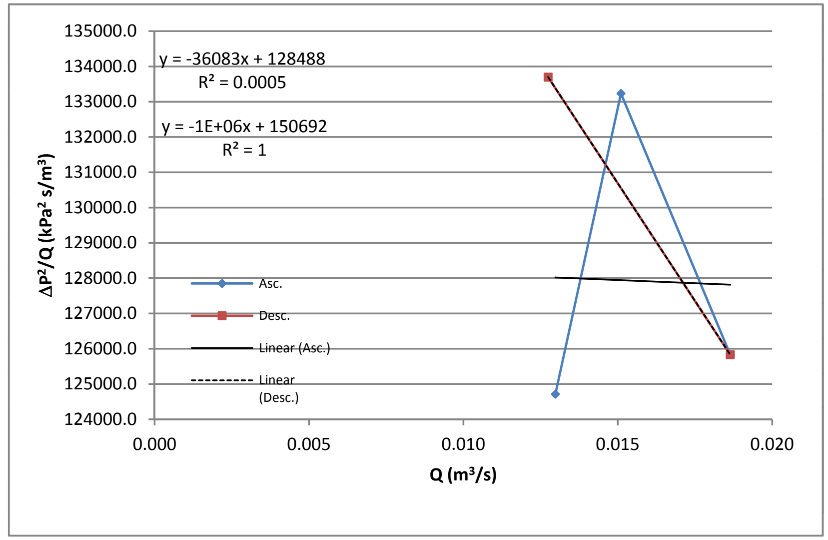
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
CMT 145	1	1.50	0.50	-0.50	0.50	0.50	0.00	0.00
	2	2.25	0.50	0.00	0.75	0.75	0.00	0.00
	3	2.50	1.00	0.00	0.50	1.00	0.00	0.00
	4	2.25	1.25	0.00	0.75	1.00	0.00	0.00
	5	---	---	---	---	---	---	---

		1 [2.0]	2 [4.0]	3 [6.0]	4 [8.0]	5 [12.0]	6 [14.0]	7 [16.0]
CMT 146	1	---	---	---	---	---	---	---
	2	---	---	---	---	---	---	---
	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---

		1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
CMT 147	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---





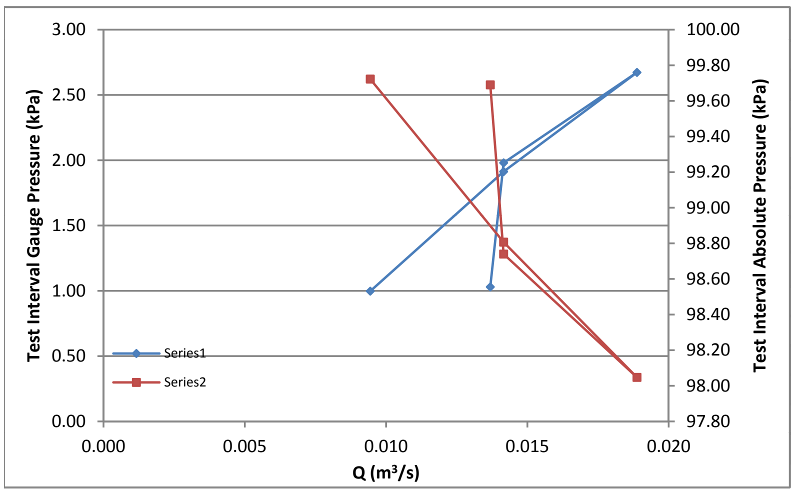
Q/P (m^3/s kPa)
1.55E-03
1.43E-03
1.50E-03
1.44E-03

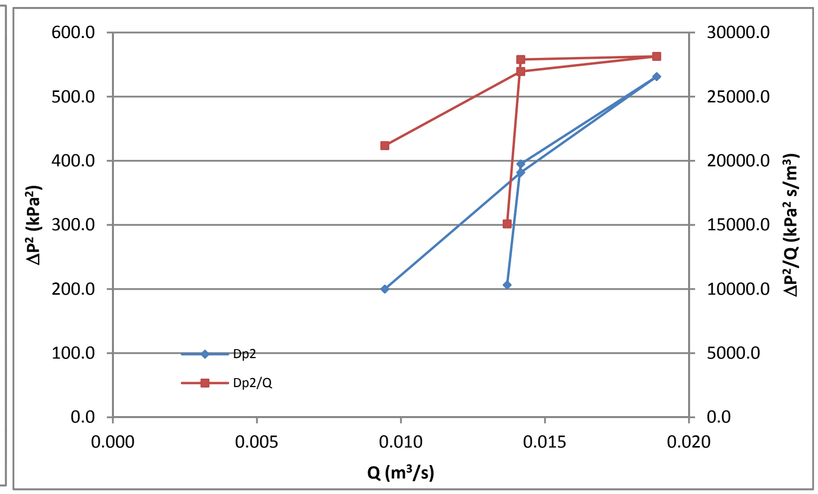
Packer Test:	**180909-C-VERT-1**
Client:	Syncrude Canada Ltd.

Test Date	18-Sep-09
Beginning Time	11:15:15
Ending Time	12:04:30
Test Interval Length (m)	1.38
Center of Test Interval (m)	3.18
Test Interval Temperature	10.7
Ambient Barometric Pressure (kPa)	100.7

Measurement	**Depth** (m)
Top of Upper Packer	1.63
Top of Test Interval	2.49
Bottom of Test Interval	3.87
Bottom of Lower Packer	4.73

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\ s/m^3$)
1	11:20:45	11:28:45	1200	0.009	2488.06	0.14	1.00	99.72	199.9	21182.3
2	11:28:45	11:36:15	1800	0.014	2470.40	0.28	1.91	98.81	381.7	26961.5
3	11:36:15	11:46:15	2400	0.019	2455.75	0.39	2.67	98.05	531.2	28140.3
4	11:46:15	11:55:45	1800	0.014	2469.11	0.29	1.98	98.74	395.0	27895.9
5	11:55:45	12:04:30	1740	0.014	2487.44	0.15	1.03	99.69	206.4	15079.3





Packer Test: **180909-C-VERT-1**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	***Initial Reading***	*-2.00*	*-0.50*	*-2.00*	*-1.50*	*-1.00*	*-1.00*	*-0.75*
	1	-1.00	2.00	-1.50	-0.50	-1.00	-0.50	0.00
	2	-0.50	2.50	-1.00	-0.50	-1.00	-0.50	0.00
	3	-1.00	2.50	-1.00	-0.75	-1.00	-0.75	0.00
	4	-0.50	2.25	-1.00	-0.50	-1.00	-0.50	0.00
	5	-0.50	1.75	-1.00	-0.50	-0.75	-0.50	0.00

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	***Initial Reading***	*-1.50*	*-1.50*	*-1.75*	*-0.75*	*-1.50*	*-1.00*	*-1.00*
	1	-1.00	-1.50	-1.50	-0.50	-1.50	-1.00	-1.00
	2	-1.00	-1.50	-1.50	-0.25	-1.50	-0.75	-0.75
	3	-0.25	-1.00	-1.00	0.25	-1.25	-1.00	-1.00
	4	-0.50	-1.00	-1.50	0.25	-1.50	-1.00	-1.00
	5	-0.50	-1.25	-1.25	0.00	-1.00	-0.75	-1.00

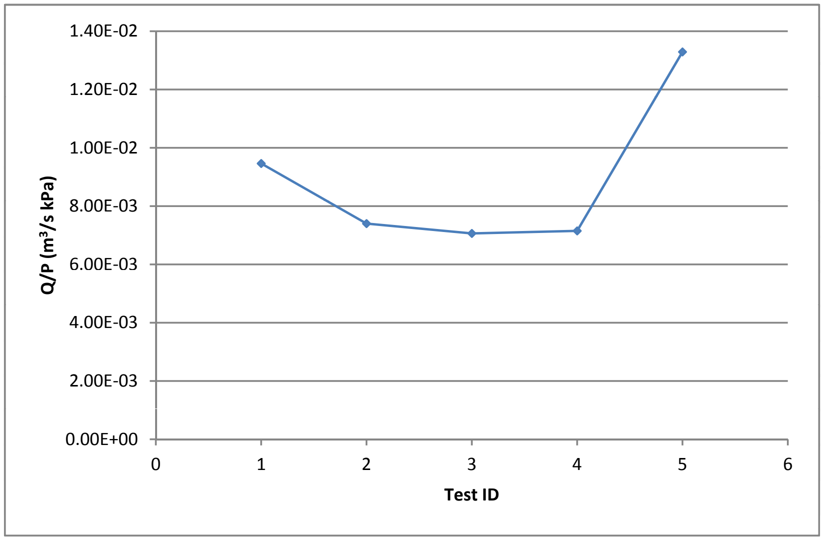
		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	***Initial Reading***	*0.00*	*-0.50*	*0.00*	*-0.25*	*0.00*	*0.00*
	1	-1.00	-1.00	0.00	0.00	0.00	0.50
	2	-1.00	-0.50	0.00	0.00	0.00	0.00
	3	-1.00	0.00	0.00	0.00	0.50	0.00
	4	-1.00	-0.50	0.00	0.00	0.00	0.50
	5	-1.00	0.00	0.50	0.00	0.50	0.50

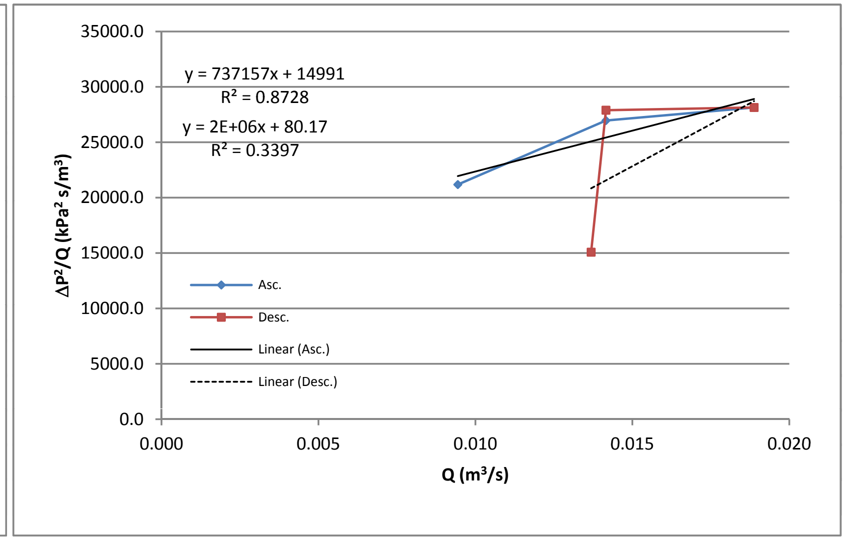
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	1	1.00	2.50	0.50	1.00	0.00	0.50	0.75
	2	1.50	3.00	1.00	1.00	0.00	0.50	0.75
	3	1.00	3.00	1.00	0.75	0.00	0.25	0.75
	4	1.50	2.75	1.00	1.00	0.00	0.50	0.75
	5	1.50	2.25	1.00	1.00	0.25	0.50	0.75

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	1	0.50	0.00	0.25	0.25	0.00	0.00	0.00
	2	0.50	0.00	0.25	0.50	0.00	0.25	0.25
	3	1.25	0.50	0.75	1.00	0.25	0.00	0.00
	4	1.00	0.50	0.25	1.00	0.00	0.00	0.00
	5	1.00	0.25	0.50	0.75	0.50	0.25	0.00

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	1	-1.00	-0.50	0.00	0.25	0.00	0.50
	2	-1.00	0.00	0.00	0.25	0.00	0.00
	3	-1.00	0.50	0.00	0.25	0.50	0.00
	4	-1.00	0.00	0.00	0.25	0.00	0.50
	5	-1.00	0.50	0.50	0.25	0.50	0.50





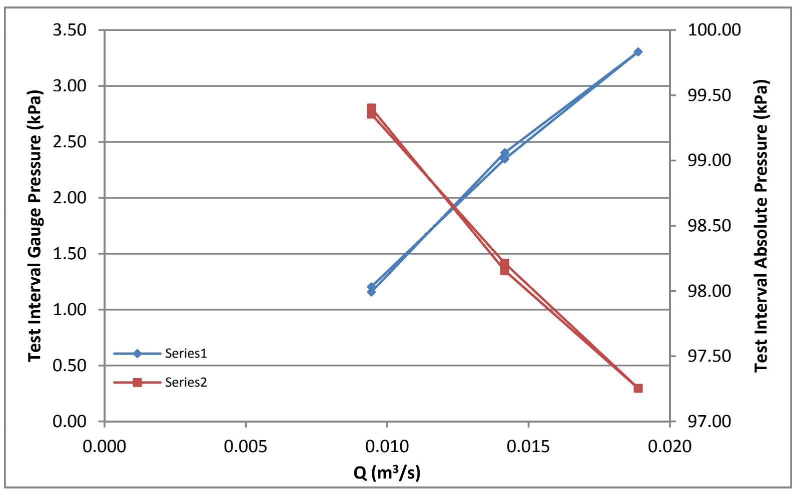
Q/P $(m^3/s\ kPa)$
9.46E-03
7.40E-03
7.06E-03
7.15E-03
1.33E-02

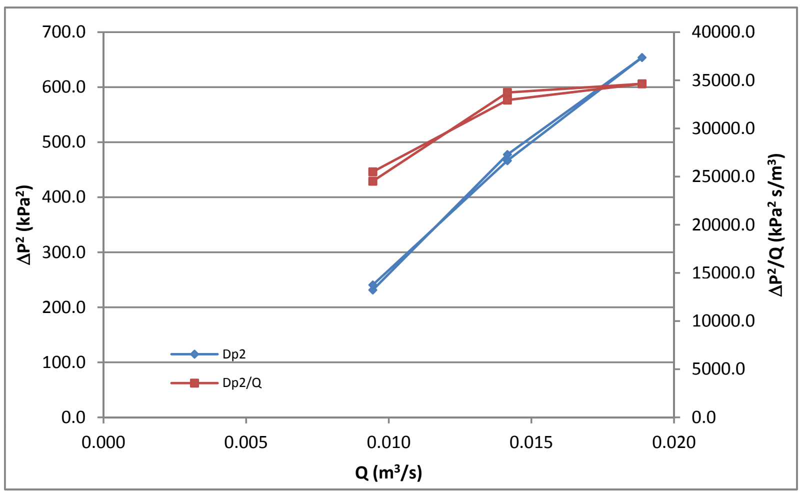
Packer Test:	**180909-C-VERT-2**
Client:	Syncrude Canada Ltd.
Test Date	18-Sep-09
Beginning Time	12:12:45
Ending Time	12:57:30
Test Interval Length (m)	1.38
Center of Test Interval (m)	4.56
Test Interval Temperature	10.7
Ambient Barometric Pressure (kPa)	100.6

Measurement	**Depth** (m)
Top of Upper Packer	3.01
Top of Test Interval	3.87
Bottom of Test Interval	5.25
Bottom of Lower Packer	6.11

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\,s/m^3$)
1	15:00:30	15:09:00	1200	0.009	2484.98	0.17	1.16	99.40	231.5	24520.9
2	15:09:00	15:14:15	1800	0.014	2460.94	0.35	2.40	98.16	477.6	33731.5
3	15:14:15	15:23:45	2400	0.019	2443.54	0.48	3.31	97.25	653.9	34636.3
4	15:23:45	15:27:15	1800	0.014	2462.04	0.34	2.35	98.21	466.5	32946.9
5	15:27:15	15:30:45	1200	0.009	2484.08	0.17	1.20	99.36	240.7	25497.8

269





Packer Test: **180909-C-VERT-2**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
CMT 145	***Initial Reading***	*-2.00*	*-0.50*	*-2.00*	*-1.50*	*-1.00*	*-1.00*	*-0.75*
	1	-1.00	1.00	-1.00	-0.75	-1.00	-0.50	-1.00
	2	-1.00	1.50	-0.50	0.00	-0.50	0.00	0.00
	3	-1.00	2.00	-0.50	0.00	-0.50	-0.25	0.00
	4	0.00	1.50	---	---	---	0.00	0.00
	5	---	---	---	---	---	---	---

		1 [2.0]	2 [4.0]	3 [6.0]	4 [8.0]	5 [12.0]	6 [14.0]	7 [16.0]
CMT 146	***Initial Reading***	*-1.00*	*-1.00*	*-2.00*	*-0.75*	*-1.00*	*-1.00*	*0.00*
	1	1.00	0.50	-0.75	1.00	0.50	1.00	-0.25
	2	1.00	-0.25	-0.50	1.00	0.00	0.00	0.00
	3	1.00	0.50	-0.25	1.50	0.00	0.00	0.00
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---

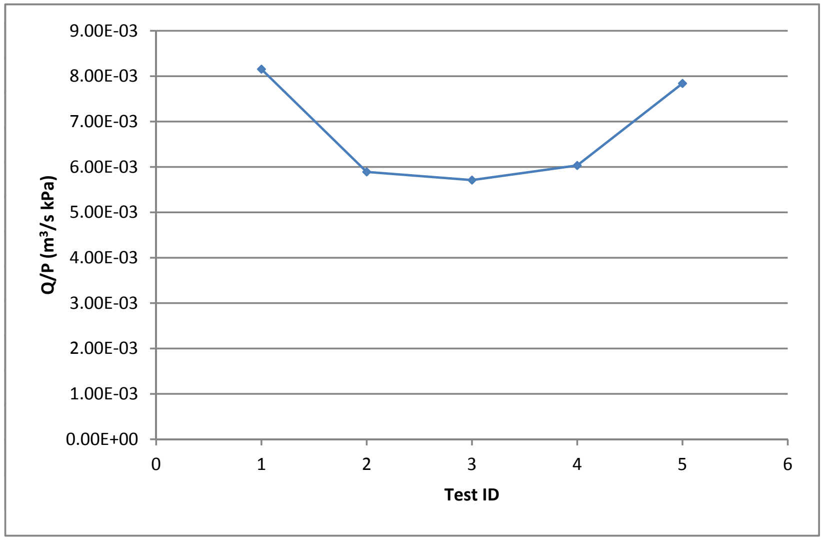
		1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
CMT 147	***Initial Reading***	---	---	---	---	---	---
	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---

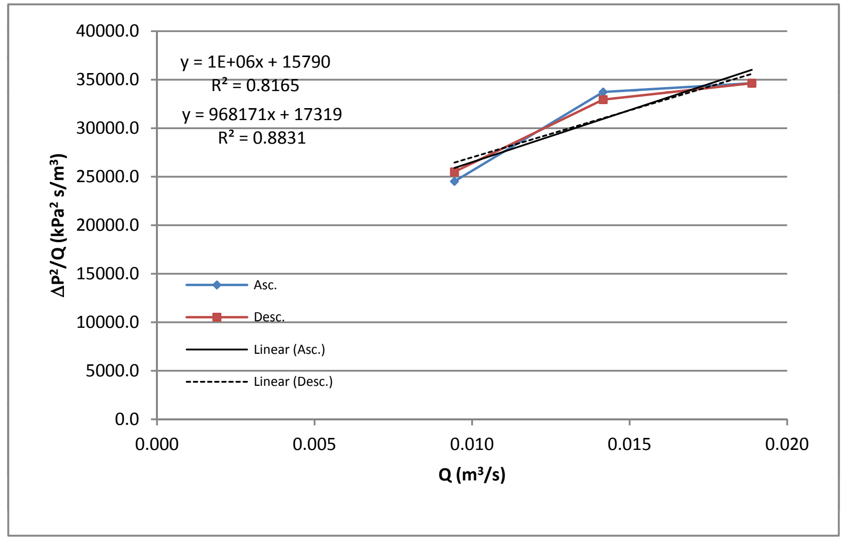
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
CMT 145	1	1.00	1.50	1.00	0.75	0.00	0.50	-0.25
	2	1.00	2.00	1.50	1.50	0.50	1.00	0.75
	3	1.00	2.50	1.50	1.50	0.50	0.75	0.75
	4	2.00	2.00	---	---	---	1.00	0.75
	5	---	---	---	---	---	---	---

		1 [2.0]	2 [4.0]	3 [6.0]	4 [8.0]	5 [12.0]	6 [14.0]	7 [16.0]
CMT 146	1	2.00	1.50	1.25	1.75	1.50	2.00	-0.25
	2	2.00	0.75	1.50	1.75	1.00	1.00	0.00
	3	2.00	1.50	1.75	2.25	1.00	1.00	0.00
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---

		1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
CMT 147	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---





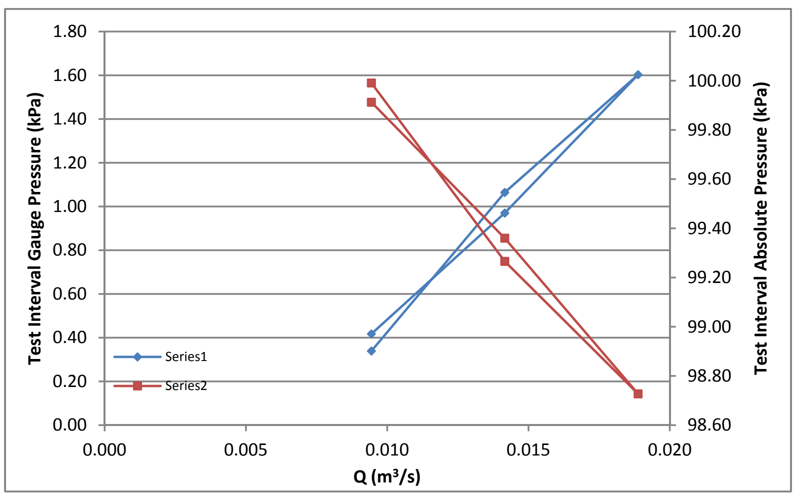
Q/P (m^3/s kPa)
8.15E-03
5.89E-03
5.71E-03
6.03E-03
7.84E-03

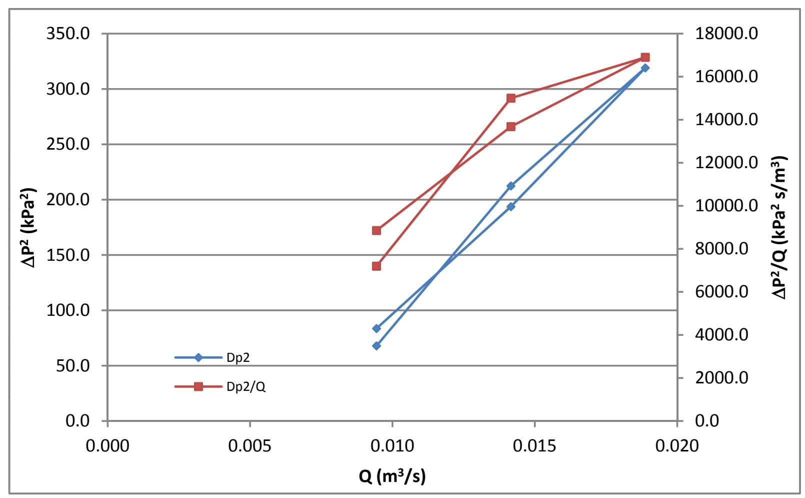
Packer Test:	**180909-C-VERT-3**
Client:	Syncrude Canada Ltd.

Test Date	18-Sep-09
Beginning Time	14:41:45
Ending Time	15:35:30
Test Interval Length (m)	1.38
Center of Test Interval (m)	5.94
Test Interval Temperature	11.6
Ambient Barometric Pressure (kPa)	100.3

Measurement	**Depth** (m)
Top of Upper Packer	4.39
Top of Test Interval	5.25
Bottom of Test Interval	6.63
Bottom of Lower Packer	7.49

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\ s/m^3$)
1	14:44:30	14:54:15	1200	0.009	2499.26	0.06	0.42	99.91	83.6	8853.2
2	14:54:15	15:04:45	1800	0.014	2488.60	0.14	0.97	99.36	193.7	13680.5
3	15:04:45	15:14:00	2400	0.019	2476.39	0.23	1.60	98.73	319.0	16900.0
4	15:14:00	15:20:45	1800	0.014	2486.78	0.15	1.06	99.27	212.4	15002.2
5	15:20:45	15:35:30	1200	0.009	2500.77	0.05	0.34	99.99	67.9	7195.1





Packer Test: **180909-C-VERT-3**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)] 1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
CMT 145	*Initial Reading*	*-2.00*	*-0.50*	*-2.00*	*-1.50*	*-1.00*	*-1.00*	*-0.75*
	1	-1.50	-1.50	-1.75	-1.00	-1.50	-1.00	-2.00
	2	-1.50	-1.50	-1.75	-0.75	-1.00	-0.75	0.00
	3	-1.25	-1.00	-1.00	0.00	-0.50	-1.00	-0.50
	4	-1.50	-1.25	-1.50	0.00	-0.50	-1.00	0.00
	5	-1.50	-1.50	-1.50	-0.25	-1.00	-1.00	-1.25

		1 [2.0]	2 [4.0]	3 [6.0]	4 [8.0]	5 [12.0]	6 [14.0]	7 [16.0]
CMT 146	*Initial Reading*	*-1.50*	*-1.50*	*-1.75*	*-0.75*	*-1.50*	*-1.00*	*-1.00*
	1	-1.50	-0.50	-1.00	-0.50	-1.00	-0.25	-0.50
	2	-2.00	-0.50	-0.50	-0.75	-1.00	0.00	-0.50
	3	-2.00	-0.25	-0.25	0.75	-0.75	0.00	-0.25
	4	-2.00	-0.50	-0.50	0.00	-1.00	0.00	-0.25
	5	-2.00	-0.50	-1.00	-0.50	-1.50	-0.25	-0.75

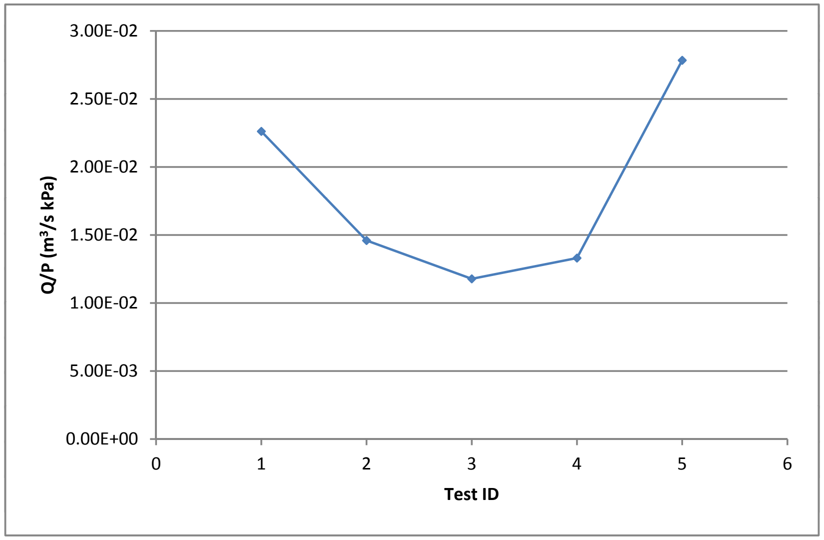
		1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
CMT 147	*Initial Reading*	*0.00*	*-0.50*	*0.00*	*-0.25*	*0.00*	*0.00*
	1	0.00	-0.50	0.00	-0.25	0.00	0.00
	2	-0.50	-0.50	0.00	-0.50	0.00	0.00
	3	-0.75	-1.00	0.00	-0.50	-0.50	-0.75
	4	-1.00	-1.00	-0.50	-0.50	-0.50	-1.00
	5	-1.00	-0.50	1.00	-0.50	0.00	-0.50

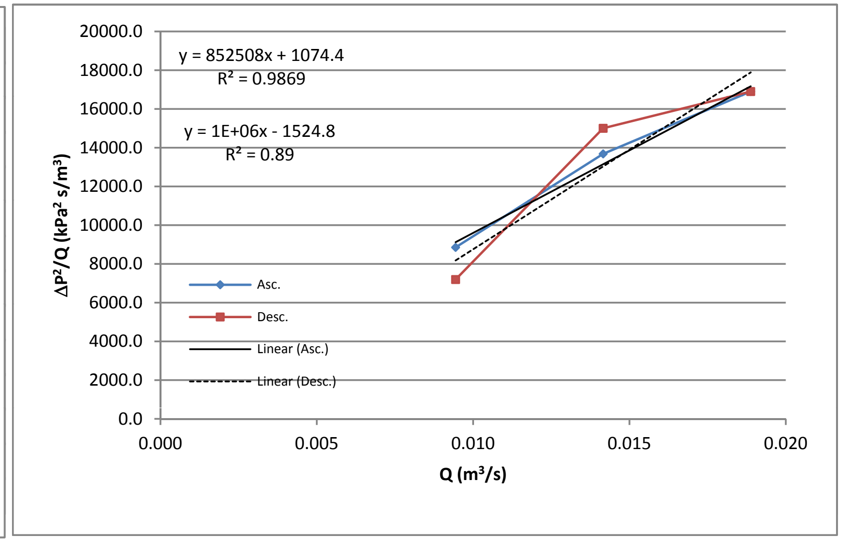
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)] 1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
CMT 145	1	0.50	-1.00	0.25	0.50	-0.50	0.00	-1.25
	2	0.50	-1.00	0.25	0.75	0.00	0.25	0.75
	3	0.75	-0.50	1.00	1.50	0.50	0.00	0.25
	4	0.50	-0.75	0.50	1.50	0.50	0.00	0.75
	5	0.50	-1.00	0.50	1.25	0.00	0.00	-0.50

		1 [2.0]	2 [4.0]	3 [6.0]	4 [8.0]	5 [12.0]	6 [14.0]	7 [16.0]
CMT 146	1	0.00	1.00	0.75	0.25	0.50	0.75	0.50
	2	-0.50	1.00	1.25	0.00	0.50	1.00	0.50
	3	-0.50	1.25	1.50	1.50	0.75	1.00	0.75
	4	-0.50	1.00	1.25	0.75	0.50	1.00	0.75
	5	-0.50	1.00	0.75	0.25	0.00	0.75	0.25

		1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
CMT 147	1	0.00	0.00	0.00	0.00	0.00	0.00
	2	-0.50	0.00	0.00	-0.25	0.00	0.00
	3	-0.75	-0.50	0.00	-0.25	-0.50	-0.75
	4	-1.00	-0.50	-0.50	-0.25	-0.50	-1.00
	5	-1.00	0.00	1.00	-0.25	0.00	-0.50



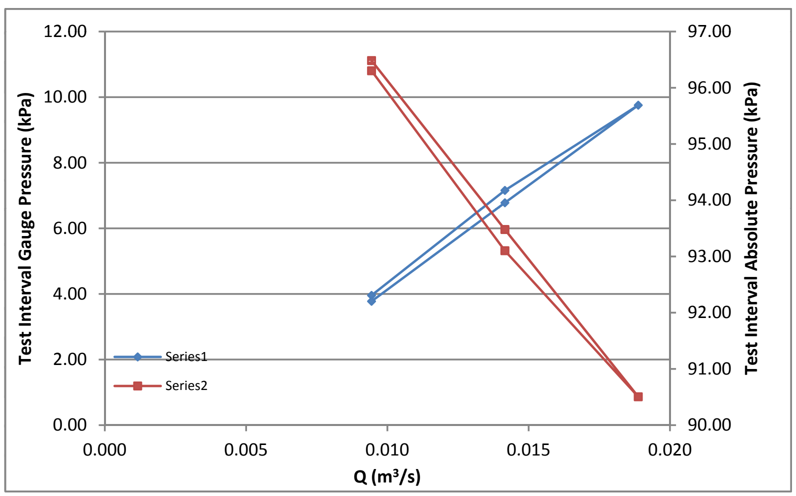


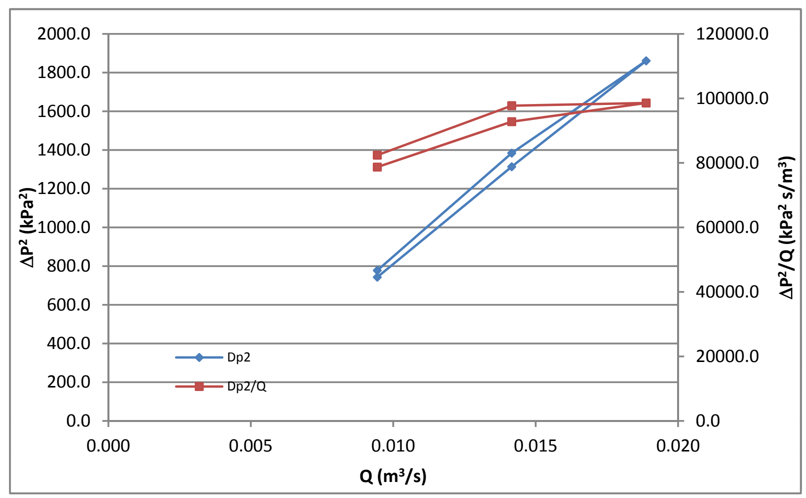
Q/P (m^3/s kPa)
2.26E-02
1.46E-02
1.18E-02
1.33E-02
2.78E-02

Packer Test:	**180909-C-VERT-4**
Client:	Syncrude Canada Ltd.
Test Date	18-Sep-09
Beginning Time	15:35:30
Ending Time	16:31:30
Test Interval Length (m)	1.38
Center of Test Interval (m)	7.32
Test Interval Temperature	12.5
Ambient Barometric Pressure (kPa)	100.3

Measurement	**Depth** (m)
Top of Upper Packer	5.77
Top of Test Interval	6.63
Bottom of Test Interval	8.01
Bottom of Lower Packer	8.87

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** (kPa^2 s/m^3)
1	15:40:00	15:51:00	1200	0.009	2430.98	0.57	3.96	96.30	777.8	82399.7
2	15:51:00	15:59:45	1800	0.014	2369.24	1.04	7.16	93.10	1383.9	97744.3
3	15:59:45	16:10:00	2400	0.019	2319.13	1.41	9.75	90.51	1860.9	98575.1
4	16:10:00	16:22:00	1800	0.014	2376.51	0.98	6.78	93.48	1313.6	92779.2
5	16:22:00	16:31:30	1200	0.009	2434.47	0.55	3.78	96.48	742.8	78700.5





Packer Test: **180909-C-VERT-4**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	***Initial Reading***	*-2.00*	*-1.00*	*-1.75*	*-1.13*	*-0.75*	*-0.63*	*-0.63*
	1	-2.00	-1.00	-1.50	1.50	0.25	0.25	-0.50
	2	-2.00	-0.25	-1.00	3.00	1.50	1.00	0.25
	3	-2.00	-0.25	-1.50	4.00	2.00	1.50	1.00
	4	-2.00	-0.75	-1.00	3.00	1.00	0.75	0.25
	5	-2.00	-1.00	-1.50	1.75	0.50	0.25	-0.25

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	***Initial Reading***	*-1.50*	*-1.50*	*-1.75*	*-0.75*	*-1.50*	*-1.00*	*-1.00*
	1	-1.50	-1.50	-1.75	0.50	-0.50	-0.75	0.00
	2	-1.50	-1.25	-1.50	0.75	-0.50	-1.00	0.00
	3	-1.50	-1.50	-1.00	1.00	0.50	-0.75	0.00
	4	-1.50	-1.50	-1.50	0.75	-0.50	-1.00	0.00
	5	-1.50	-1.00	-1.50	0.25	-0.75	-1.25	-0.25

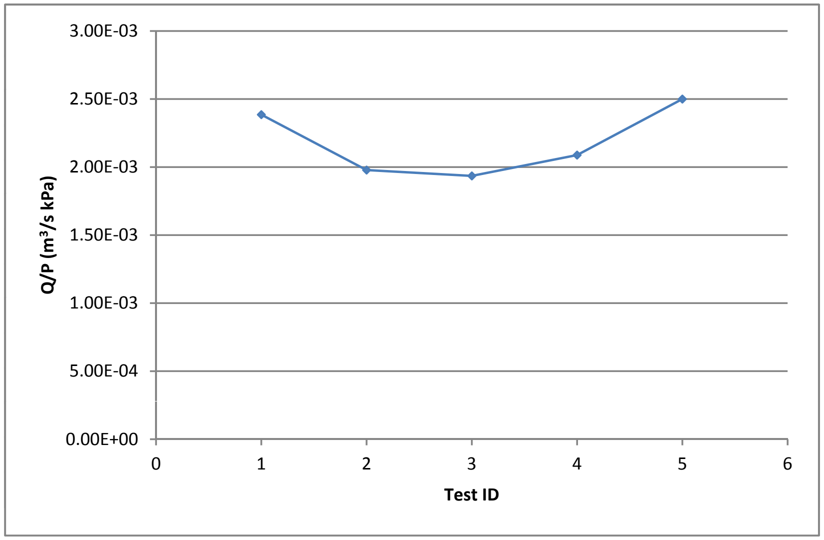
		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	***Initial Reading***	*-1.00*	*-1.00*	*0.25*	*-0.50*	*-0.50*	*0.00*
	1	-1.50	-1.50	0.00	-0.50	-0.75	-0.75
	2	-1.25	-1.50	0.25	0.00	0.00	0.00
	3	-1.00	-0.75	0.25	-0.50	-0.50	-0.50
	4	-1.00	-1.00	0.75	-0.50	-1.00	-1.25
	5	-1.50	-1.50	0.00	-1.00	-1.00	-1.50

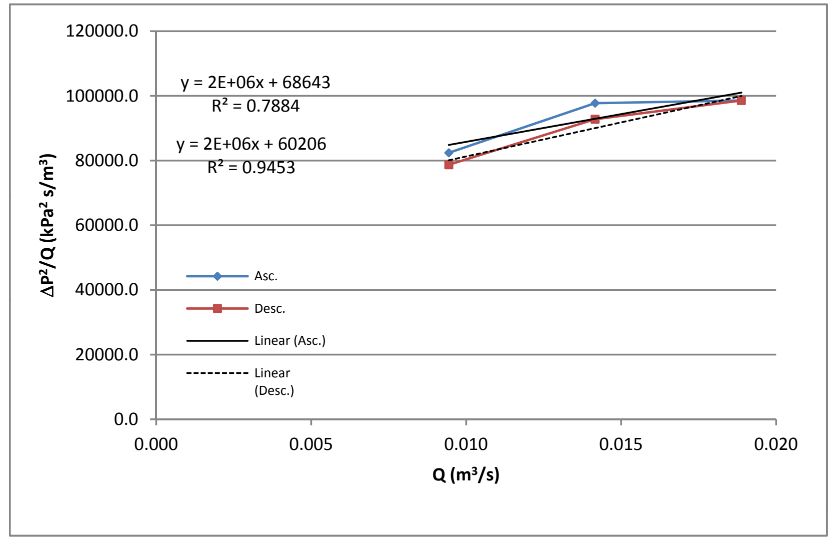
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	1	0.00	0.00	0.25	2.63	1.00	0.88	0.13
	2	0.00	0.75	0.75	4.13	2.25	1.63	0.88
	3	0.00	0.75	0.25	5.13	2.75	2.13	1.63
	4	0.00	0.25	0.75	4.13	1.75	1.38	0.88
	5	0.00	0.00	0.25	2.88	1.25	0.88	0.38

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	1	0.00	0.00	0.00	1.25	1.00	0.25	1.00
	2	0.00	0.25	0.25	1.50	1.00	0.00	1.00
	3	0.00	0.00	0.75	1.75	2.00	0.25	1.00
	4	0.00	0.00	0.25	1.50	1.00	0.00	1.00
	5	0.00	0.50	0.25	1.00	0.75	-0.25	0.75

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	1	-0.50	-0.50	-0.25	0.00	-0.25	-0.75
	2	-0.25	-0.50	0.00	0.50	0.50	0.00
	3	0.00	0.25	0.00	0.00	0.00	-0.50
	4	0.00	0.00	0.50	0.00	-0.50	-1.25
	5	-0.50	-0.50	-0.25	-0.50	-0.50	-1.50





Q/P (m^3/s kPa)
2.39E-03
1.98E-03
1.94E-03
2.09E-03
2.50E-03

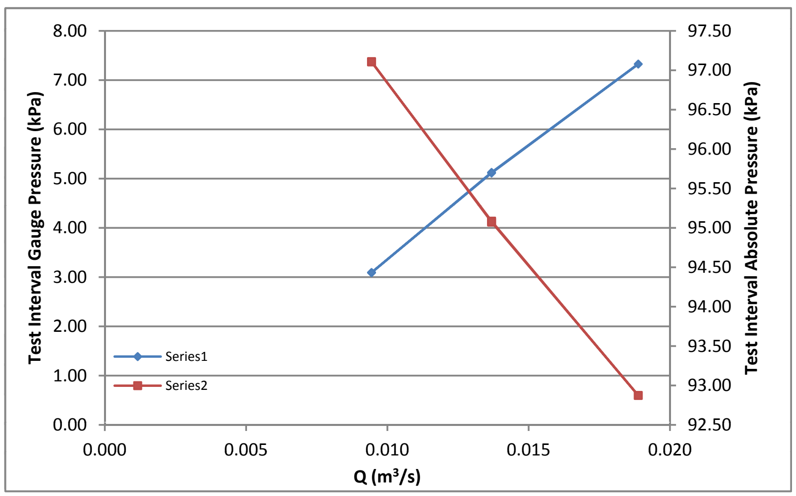
Packer Test: **180909-C-VERT-5**

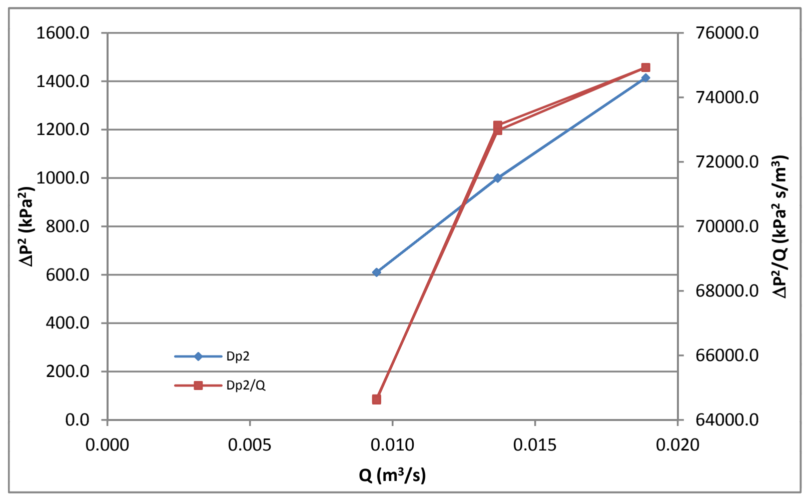
Client: Syncrude Canada Ltd.

Test Date	18-Sep-09
Beginning Time	16:36:30
Ending Time	17:41:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	8.7
Test Interval Temperature	13.5
Ambient Barometric Pressure (kPa)	100.2

Measurement	**Depth** (m)
Top of Upper Packer	7.15
Top of Test Interval	8.01
Bottom of Test Interval	9.39
Bottom of Lower Packer	10.25

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\ s/m^3$)
1	16:43:45	16:54:00	1200	0.009	2447.64	0.45	3.09	97.11	610.3	64654.0
2	16:54:00	17:03:45	1740	0.014	2408.65	0.74	5.11	95.09	998.7	72973.2
3	17:03:45	17:17:00	2400	0.019	2365.98	1.06	7.33	92.87	1414.5	74927.7
4	17:17:00	17:30:00	1740	0.014	2408.42	0.74	5.13	95.07	1001.0	73137.9
5	17:30:00	17:41:00	1200	0.009	2447.67	0.45	3.09	97.11	609.9	64618.4





Packer Test: **180909-C-VERT-5**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	***Initial Reading***	*-2.00*	*-1.00*	*-1.75*	*-1.13*	*-0.75*	*-0.63*	*-0.63*
	1	-2.00	-1.00	-1.25	1.75	1.00	0.50	0.00
	2	-2.00	-1.00	-1.25	2.75	1.50	1.00	0.50
	3	-2.00	-0.75	-0.75	3.50	2.00	1.25	1.00
	4	-2.00	-0.50	-1.00	2.50	1.75	1.50	1.00
	5	-2.00	-0.25	-1.50	1.75	1.50	1.00	0.75

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	***Initial Reading***	*-1.50*	*-1.50*	*-1.75*	*-0.75*	*-1.50*	*-1.00*	*-1.00*
	1	-1.50	-1.00	-1.50	0.50	-0.50	-0.75	0.00
	2	-1.50	-1.00	-1.50	0.75	-0.50	-0.75	-0.75
	3	-1.50	-1.00	-1.50	1.00	-0.25	-0.75	0.00
	4	-1.50	-1.00	-1.50	0.50	-0.50	-1.00	0.00
	5	-1.50	-1.00	-1.50	0.25	-0.50	-1.00	0.00

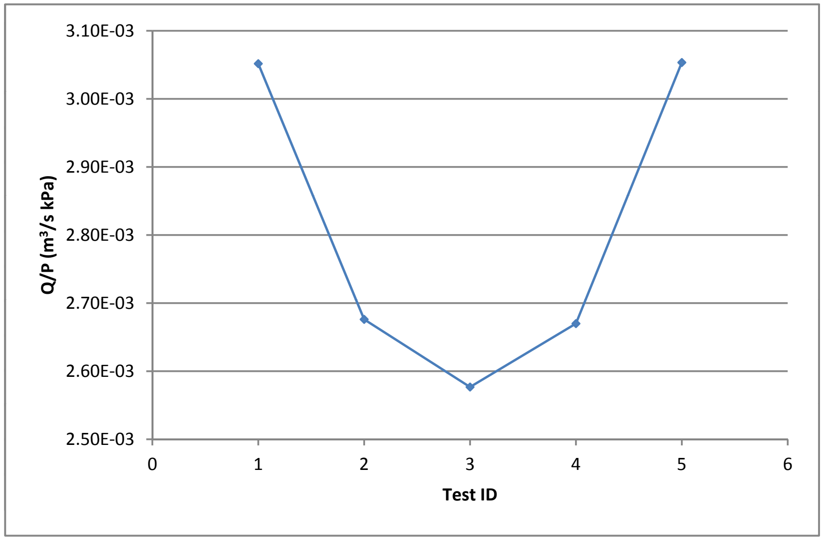
		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	***Initial Reading***	*-1.00*	*-1.00*	*0.25*	*-0.50*	*-0.50*	*0.00*
	1	-1.00	-1.50	0.00	-0.50	-0.75	-1.00
	2	-1.50	-1.50	-0.50	-0.50	-0.50	-0.75
	3	-1.00	-1.00	0.50	-0.50	0.00	-0.25
	4	-1.00	-0.75	0.50	-0.75	-0.75	-0.75
	5	-1.00	-0.75	0.50	-0.50	-0.50	-1.00

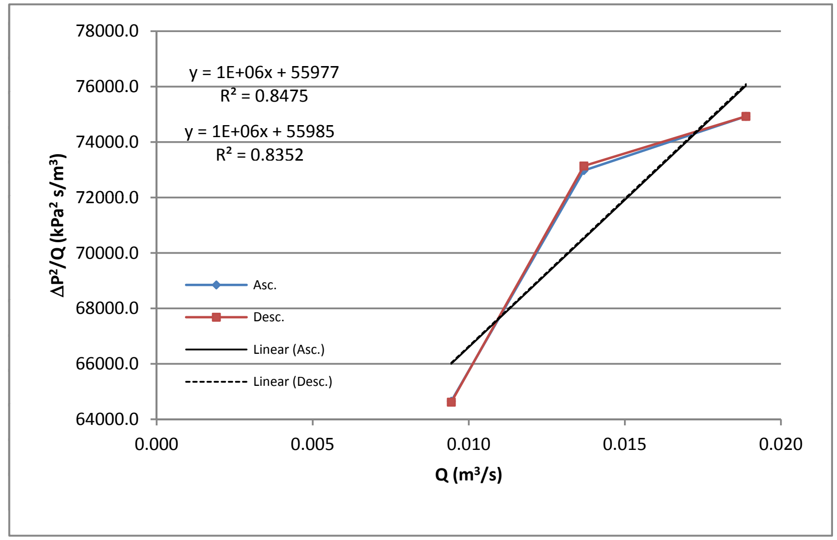
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	1	0.00	0.00	0.50	2.88	1.75	1.13	0.63
	2	0.00	0.00	0.50	3.88	2.25	1.63	1.13
	3	0.00	0.25	1.00	4.63	2.75	1.88	1.63
	4	0.00	0.50	0.75	3.63	2.50	2.13	1.63
	5	0.00	0.75	0.25	2.88	2.25	1.63	1.38

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	1	0.00	0.50	0.25	1.25	1.00	0.25	1.00
	2	0.00	0.50	0.25	1.50	1.00	0.25	0.25
	3	0.00	0.50	0.25	1.75	1.25	0.25	1.00
	4	0.00	0.50	0.25	1.25	1.00	0.00	1.00
	5	0.00	0.50	0.25	1.00	1.00	0.00	1.00

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	1	0.00	-0.50	-0.25	0.00	-0.25	-1.00
	2	-0.50	-0.50	-0.75	0.00	0.00	-0.75
	3	0.00	0.00	0.25	0.00	0.50	-0.25
	4	0.00	0.25	0.25	-0.25	-0.25	-0.75
	5	0.00	0.25	0.25	0.00	0.00	-1.00





Q/P (m^3/s kPa)
3.05E-03
2.68E-03
2.58E-03
2.67E-03
3.05E-03

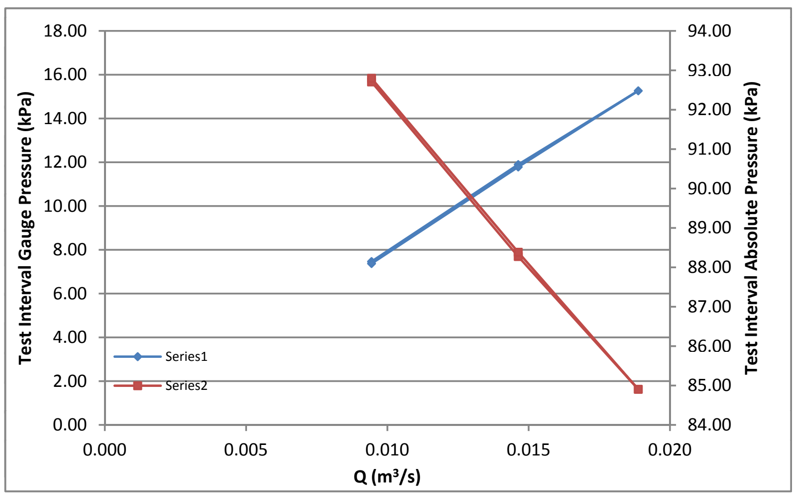
Packer Test: **180909-C-VERT-6**

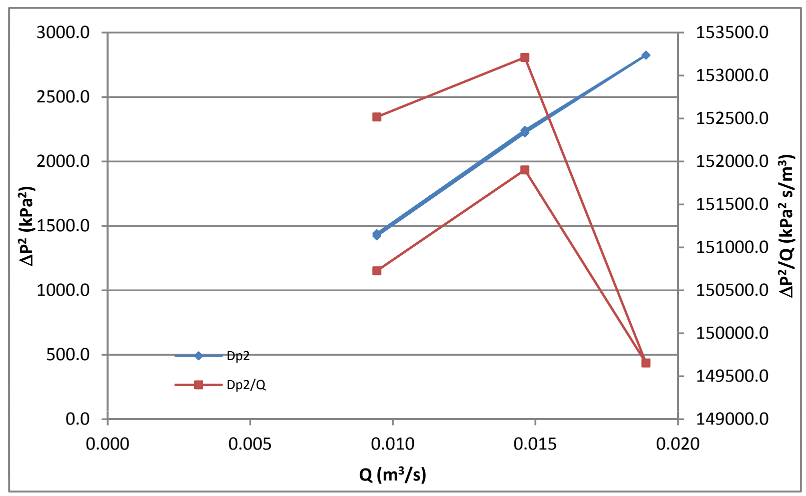
Client: Syncrude Canada Ltd.

Test Date	18-Sep-09
Beginning Time	17:47:45
Ending Time	18:25:30
Test Interval Length (m)	1.38
Center of Test Interval (m)	9.3
Test Interval Temperature	13.3
Ambient Barometric Pressure (kPa)	100.2

Measurement	**Depth** (m)
Top of Upper Packer	7.75
Top of Test Interval	8.61
Bottom of Test Interval	9.99
Bottom of Lower Packer	10.85

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\ s/m^3$)
1	17:53:00	18:01:00	1200	0.009	2363.32	1.08	7.46	92.71	1439.6	152518.1
2	18:01:00	18:07:45	1860	0.015	2277.85	1.72	11.89	88.28	2241.5	153210.8
3	18:07:45	18:14:00	2400	0.019	2212.83	2.21	15.27	84.90	2825.2	149655.2
4	18:14:00	18:18:00	1860	0.015	2279.94	1.71	11.79	88.38	2222.4	151901.8
5	18:18:00	18:25:30	1200	0.009	2365.08	1.07	7.37	92.80	1422.7	150727.6





Packer Test: **180909-C-VERT-6**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	***Initial Reading***	*-2.00*	*-1.00*	*-1.50*	*-0.75*	*-0.50*	*-0.25*	*-0.50*
	1	-2.00	-1.00	-2.00	-0.50	1.50	1.00	-0.50
	2	-2.00	-0.75	-1.75	1.00	3.50	2.00	0.75
	3	-2.00	-0.50	-1.75	1.50	4.50	3.50	1.50
	4	-2.00	-0.50	-1.50	1.00	3.50	2.00	1.00
	5	-2.00	-1.00	-1.75	0.50	2.50	2.00	0.75

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	***Initial Reading***	*-1.63*	*-1.50*	*-1.75*	*-0.63*	*-1.50*	*-1.00*	*-0.50*
	1	-1.75	-1.50	-1.75	0.25	-0.50	-1.00	-0.50
	2	-1.75	-1.50	-1.75	0.00	-0.50	-1.00	-0.50
	3	-1.75	-1.50	-1.50	0.25	-0.50	-1.00	-0.50
	4	-1.75	-1.50	-1.75	0.50	-0.50	-1.00	-0.50
	5	-1.75	-1.50	-1.75	0.50	-0.50	-1.00	-0.50

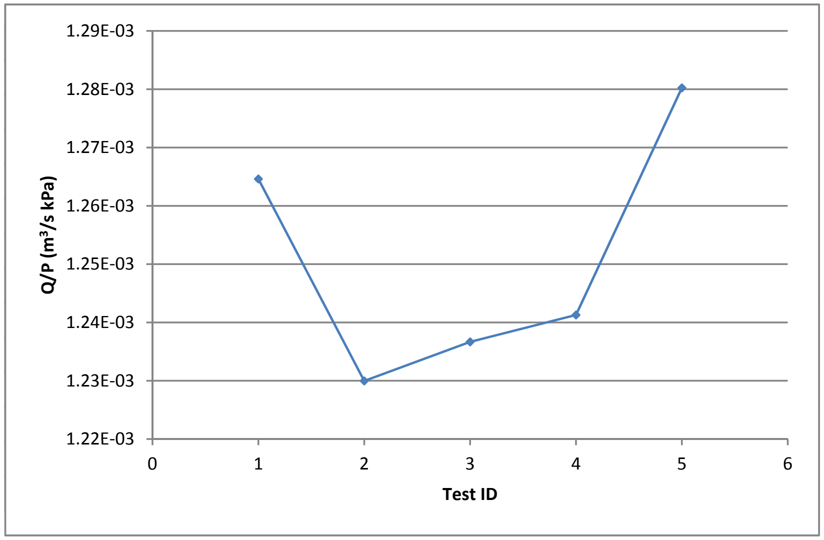
		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	***Initial Reading***	*-1.00*	*-1.00*	*0.25*	*-0.50*	*-0.50*	*0.00*
	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---

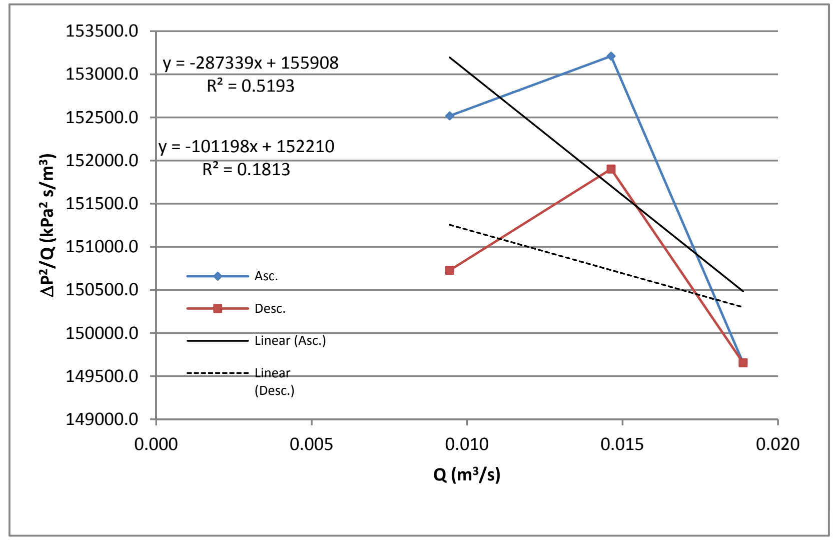
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	1	0.00	0.00	-0.50	0.25	2.00	1.25	0.00
	2	0.00	0.25	-0.25	1.75	4.00	2.25	1.25
	3	0.00	0.50	-0.25	2.25	5.00	3.75	2.00
	4	0.00	0.50	0.00	1.75	4.00	2.25	1.50
	5	0.00	0.00	-0.25	1.25	3.00	2.25	1.25

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	1	-0.13	0.00	0.00	0.88	1.00	0.00	0.00
	2	-0.13	0.00	0.00	0.63	1.00	0.00	0.00
	3	-0.13	0.00	0.25	0.88	1.00	0.00	0.00
	4	-0.13	0.00	0.00	1.13	1.00	0.00	0.00
	5	-0.13	0.00	0.00	1.13	1.00	0.00	0.00

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---





Q/P (m^3/s kPa)
1.26E-03
1.23E-03
1.24E-03
1.24E-03
1.28E-03

Packer Test:	**200909-C-ANG-1**
Client:	Syncrude Canada Ltd.

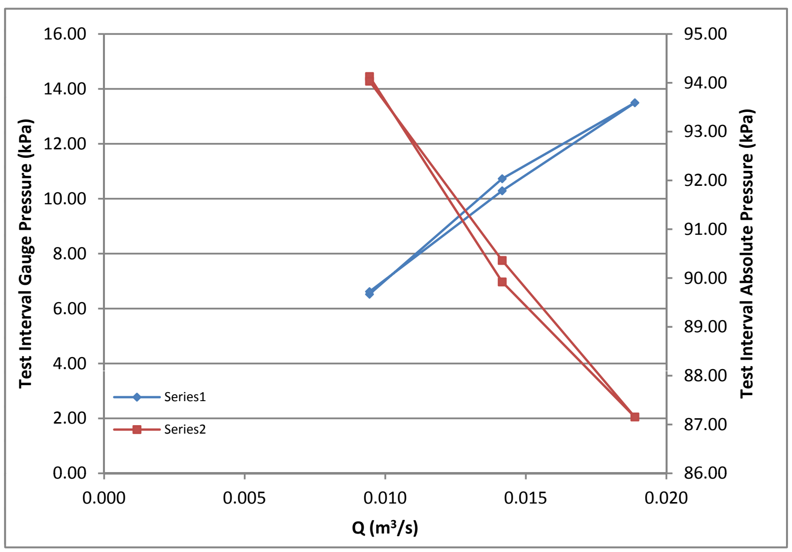
Test Date	20-Sep-09
Beginning Time	11:27:30
Ending Time	12:15:30
Test Interval Length (m)	1.38
Center of Test Interval (m)	1.39
Test Interval Temperature	15.3
Ambient Barometric Pressure (kPa	100.7

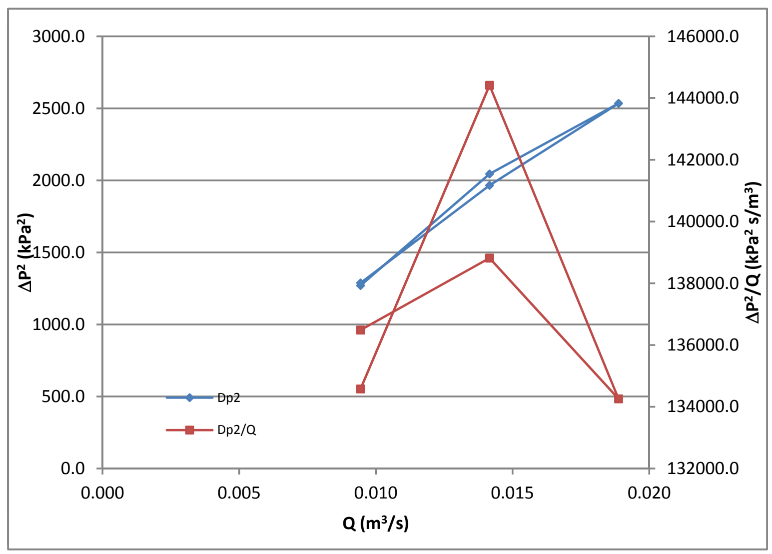
Measurement	**Depth** (m)
Top of Upper Packer	0.04
Top of Test Interval	0.90
Bottom of Test Interval	1.87
Bottom of Lower Packer	2.73

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\ s/m^3$)
1	11:35:00	11:42:45	1200	0.009	2381.50	0.94	6.52	94.13	1270.3	134577.6
2	11:42:45	11:51:15	1800	0.014	2300.33	1.55	10.73	89.92	2044.7	144413.5
3	11:51:15	12:00:15	2400	0.019	2246.97	1.95	13.50	87.15	2534.5	134257.6
4	12:00:15	12:08:15	1800	0.014	2308.81	1.49	10.29	90.36	1965.4	138816.7
5	12:08:15	12:15:30	1200	0.009	2379.65	0.96	6.62	94.03	1288.3	136485.4

Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.





Packer Test: **200909-C-ANG-1**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	*Initial Reading*	*-2.00*	*0.00*	*-0.75*	*0.25*	*-0.25*	*-0.25*	*-0.25*
	1	0.00	0.25	-0.25	-0.25	-0.50	-0.75	-0.50
	2	0.50	0.75	-1.00	0.00	0.00	-0.25	0.00
	3	1.00	1.25	-0.50	0.50	0.00	0.25	-0.25
	4	0.50	1.00	-0.75	0.00	-0.50	-0.25	-0.50
	5	0.00	0.75	-0.75	-0.25	-0.50	-0.25	-0.50

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	*Initial Reading*	*-1.00*	*-1.00*	*-1.50*	*0.00*	*-1.00*	*-1.25*	*0.50*
	1	-0.75	-0.75	-1.25	0.00	-1.00	-1.50	0.00
	2	-0.50	-0.75	-1.25	0.00	-0.75	-1.25	-0.50
	3	-1.00	-0.75	-1.00	0.00	-1.00	-1.25	-1.00
	4	-1.00	-0.50	-1.00	0.00	-0.75	-1.50	-0.50
	5	-0.50	-0.75	-0.75	-0.25	-1.00	-1.50	0.25

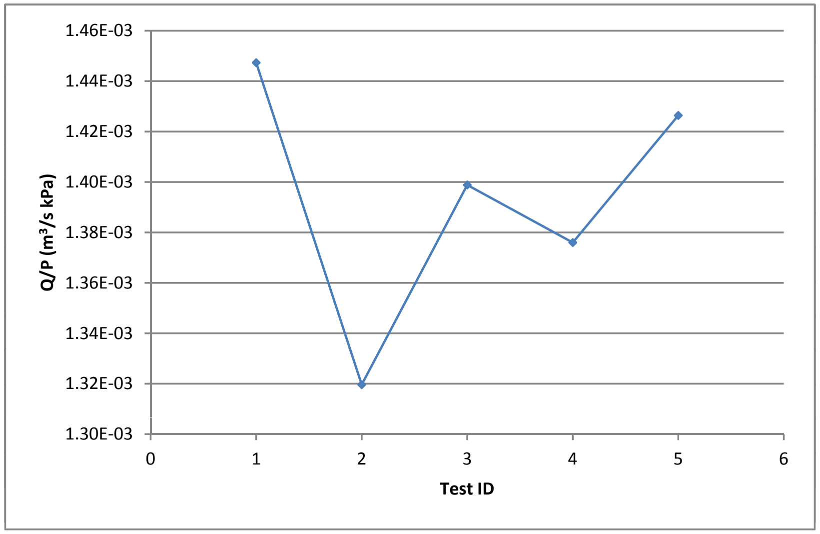
		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	*Initial Reading*	*0.00*	*-1.00*	*-1.00*	*-0.75*	*-0.50*	*-0.50*
	1	-1.00	-1.00	-1.50	-1.00	-0.50	-1.00
	2	0.50	0.25	0.00	0.50	0.75	0.75
	3	0.00	-0.50	-1.00	-0.50	0.00	0.00
	4	0.00	0.25	0.00	0.00	0.50	0.50
	5	-0.75	0.00	0.00	0.50	0.50	0.50

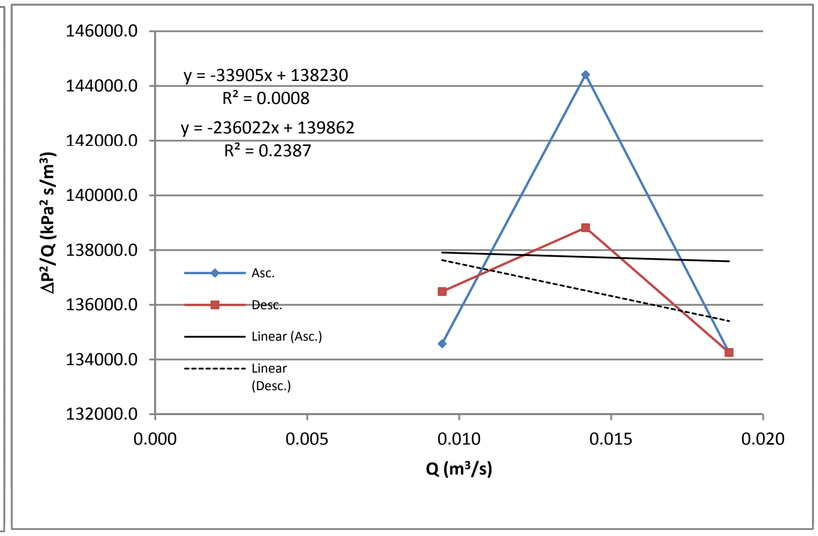
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	1	2.00	0.25	0.50	-0.50	-0.25	-0.50	-0.25
	2	2.50	0.75	-0.25	-0.25	0.25	0.00	0.25
	3	3.00	1.25	0.25	0.25	0.25	0.50	0.00
	4	2.50	1.00	0.00	-0.25	-0.25	0.00	-0.25
	5	2.00	0.75	0.00	-0.50	-0.25	0.00	-0.25

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	1	0.25	0.25	0.25	0.00	0.00	-0.25	-0.50
	2	0.50	0.25	0.25	0.00	0.25	0.00	-1.00
	3	0.00	0.25	0.50	0.00	0.00	0.00	-1.50
	4	0.00	0.50	0.50	0.00	0.25	-0.25	-1.00
	5	0.50	0.25	0.75	-0.25	0.00	-0.25	-0.25

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	1	-1.00	0.00	-0.50	-0.25	0.00	-0.50
	2	0.50	1.25	1.00	1.25	1.25	1.25
	3	0.00	0.50	0.00	0.25	0.50	0.50
	4	0.00	1.25	1.00	0.75	1.00	1.00
	5	-0.75	1.00	1.00	1.25	1.00	1.00





Q/P (m^3/s kPa)
1.45E-03
1.32E-03
1.40E-03
1.38E-03
1.43E-03

Packer Test:	**200909-C-ANG-2**
Client:	Syncrude Canada Ltd.

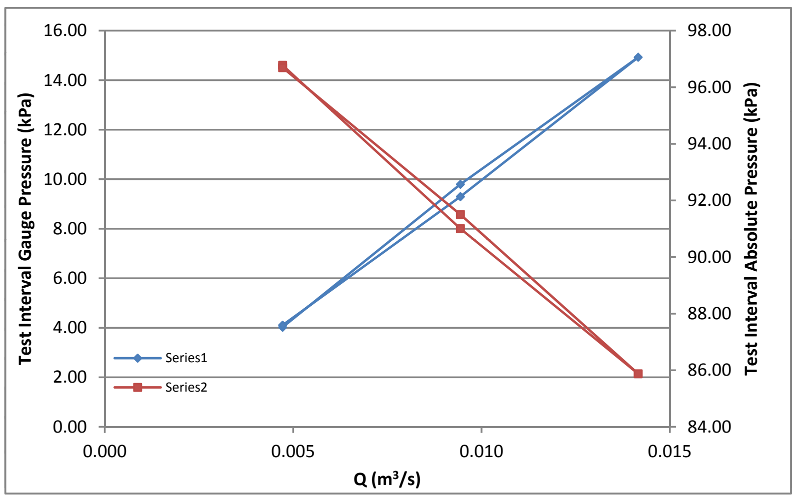
Test Date	20-Sep-09
Beginning Time	12:21:45
Ending Time	18:30:15
Test Interval Length (m)	1.38
Center of Test Interval (m)	2.36
Test Interval Temperature	12.6
Ambient Barometric Pressure (kPa)	100.8

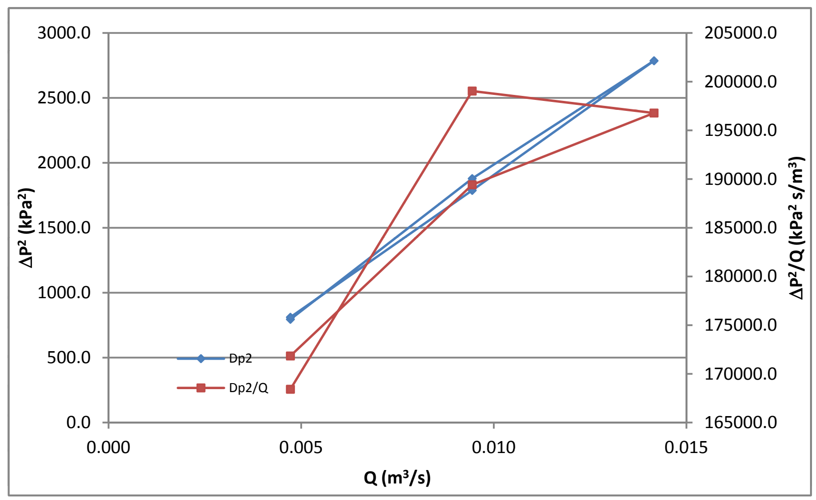
Measurement	**Depth** (m)
Top of Upper Packer	1.01
Top of Test Interval	1.87
Bottom of Test Interval	2.85
Bottom of Lower Packer	3.71

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\,s/m^3$)
1	12:26:45	12:37:00	600	0.005	2429.70	0.58	4.02	96.78	794.9	168420.1
2	12:37:00	12:45:00	1200	0.009	2318.35	1.42	9.79	91.01	1878.7	199039.6
3	12:45:00	12:52:00	1800	0.014	2219.39	2.16	14.93	85.87	2786.1	196782.1
4	12:52:00	12:58:15	1200	0.009	2327.96	1.35	9.30	91.50	1787.9	189413.7
5	12:58:15	13:01:30	600	0.005	2428.09	0.59	4.11	96.69	811.0	171839.5

Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.





Packer Test: **200909-C-ANG-2**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	***Initial Reading***	*-2.00*	*0.00*	*-0.75*	*0.25*	*-0.25*	*-0.25*	*-0.25*
	1	-0.75	0.75	-0.75	0.25	0.00	-0.25	0.00
	2	-0.50	1.00	-0.75	0.25	-0.25	0.00	0.00
	3	-0.35	1.50	-0.75	0.25	-0.25	0.00	0.00
	4	-0.75	1.00	-0.75	0.25	-0.25	0.00	0.00
	5	-1.00	0.50	---	---	---	---	---

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	***Initial Reading***	*-1.00*	*-1.00*	*-1.50*	*0.00*	*-1.00*	*-1.25*	*0.50*
	1	-0.75	-0.25	-0.75	0.25	-1.00	-1.00	-1.00
	2	-0.75	-0.50	-0.75	0.25	-1.00	-1.00	0.75
	3	-0.75	-0.50	-1.00	0.25	-1.25	-1.00	0.25
	4	-0.75	-0.50	-1.00	0.00	-1.00	-1.00	0.75
	5	---	---	---	---	---	---	---

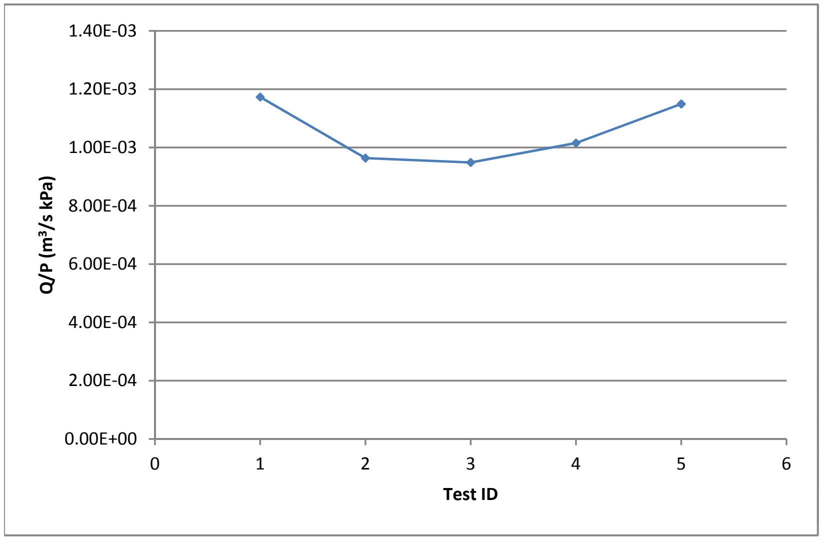
		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	***Initial Reading***	*0.00*	*-1.00*	*-1.00*	*-0.75*	*-0.50*	*-0.50*
	1	-0.25	-1.00	-1.00	-0.75	-0.50	-0.50
	2	0.00	-1.00	-1.00	-0.75	-0.75	-0.25
	3	0.00	-1.00	-1.00	-1.00	-1.00	-0.50
	4	0.00	-0.75	-0.75	-0.50	-0.50	0.00
	5	---	---	---	---	---	---

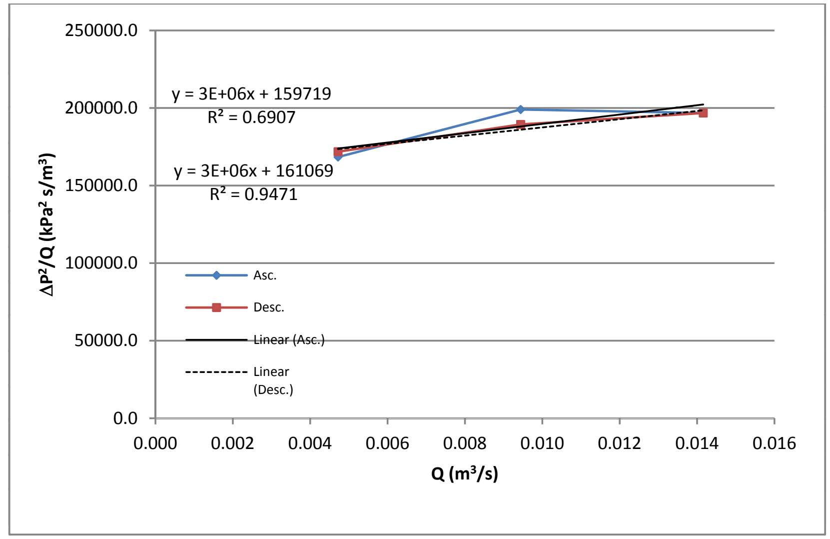
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	1	1.25	0.75	0.00	0.00	0.25	0.00	0.25
	2	1.50	1.00	0.00	0.00	0.00	0.25	0.25
	3	1.65	1.50	0.00	0.00	0.00	0.25	0.25
	4	1.25	1.00	0.00	0.00	0.00	0.25	0.25
	5	1.00	0.50	---	---	---	---	---

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	1	0.25	0.75	0.75	0.25	0.00	0.25	-1.50
	2	0.25	0.50	0.75	0.25	0.00	0.25	0.25
	3	0.25	0.50	0.50	0.25	-0.25	0.25	-0.25
	4	0.25	0.50	0.50	0.00	0.00	0.25	0.25
	5	---	---	---	---	---	---	---

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	1	-0.25	0.00	0.00	0.00	0.00	0.00
	2	0.00	0.00	0.00	0.00	-0.25	0.25
	3	0.00	0.00	0.00	-0.25	-0.50	0.00
	4	0.00	0.25	0.25	0.25	0.00	0.50
	5	---	---	---	---	---	---





Q/P (m^3/s kPa)
1.17E-03
9.64E-04
9.49E-04
1.02E-03
1.15E-03

Packer Test:	**200909-C-ANG-3**
Client:	Syncrude Canada Ltd.

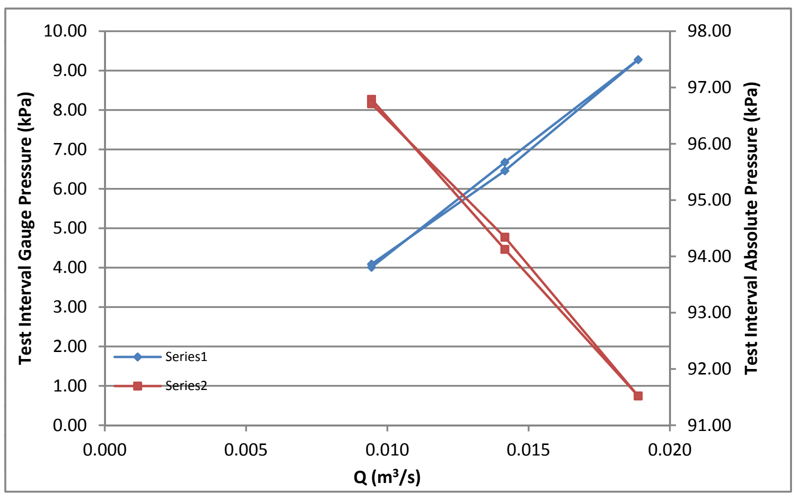
Test Date	20-Sep-09
Beginning Time	14:09:15
Ending Time	14:47:30
Test Interval Length (m)	1.38
Center of Test Interval (m)	3.34
Test Interval Temperature	11.2
Ambient Barometric Pressure (kPa)	100.8

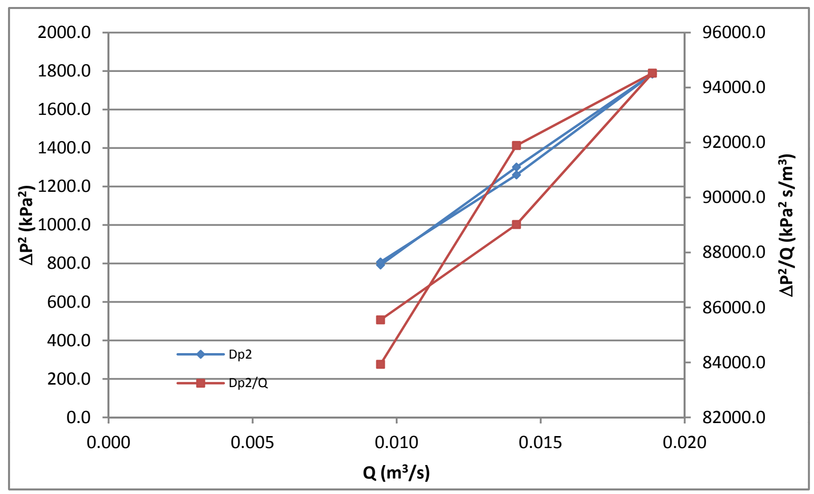
Measurement	**Depth** (m)
Top of Upper Packer	1.99
Top of Test Interval	2.85
Bottom of Test Interval	3.83
Bottom of Lower Packer	4.69

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2 s/m^3$)
1	14:12:00	14:19:00	1200	0.009	2429.96	0.58	4.01	96.79	792.2	83932.0
2	14:19:00	14:27:00	1800	0.014	2378.55	0.97	6.67	94.13	1301.1	91892.6
3	14:27:00	14:33:45	2400	0.019	2328.32	1.34	9.28	91.52	1784.4	94525.1
4	14:33:45	14:40:45	1800	0.014	2382.71	0.93	6.46	94.34	1260.4	89018.0
5	14:40:45	14:47:30	1200	0.009	2428.44	0.59	4.09	96.71	807.5	85549.0

Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.





Packer Test: **200909-C-ANG-3**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	***Initial Reading***	-2.00	0.00	-0.75	0.25	-0.25	-0.25	-0.25
	1	-0.75	1.00	-0.50	0.25	0.00	-0.25	-0.25
	2	-0.75	1.50	-0.50	0.50	0.00	-0.25	-0.25
	3	-0.50	2.00	-0.50	0.50	0.00	0.00	-0.25
	4	-0.75	1.50	-0.50	0.25	-0.25	-0.25	-0.50
	5	-1.00	1.25	-0.75	0.00	-0.25	-0.25	-0.50

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	***Initial Reading***	-1.00	-1.00	-1.50	0.00	-1.00	-1.25	0.50
	1	-0.75	-0.75	-0.75	0.00	-0.75	-1.00	-0.75
	2	-0.50	-0.50	-1.00	0.00	-1.00	-1.25	-1.25
	3	-0.50	-0.50	-1.00	0.00	-1.25	-1.00	0.75
	4	-0.75	-0.75	-1.00	-0.25	-1.25	-1.50	0.50
	5	-1.00	-1.00	-1.50	-0.25	-1.50	-1.25	0.50

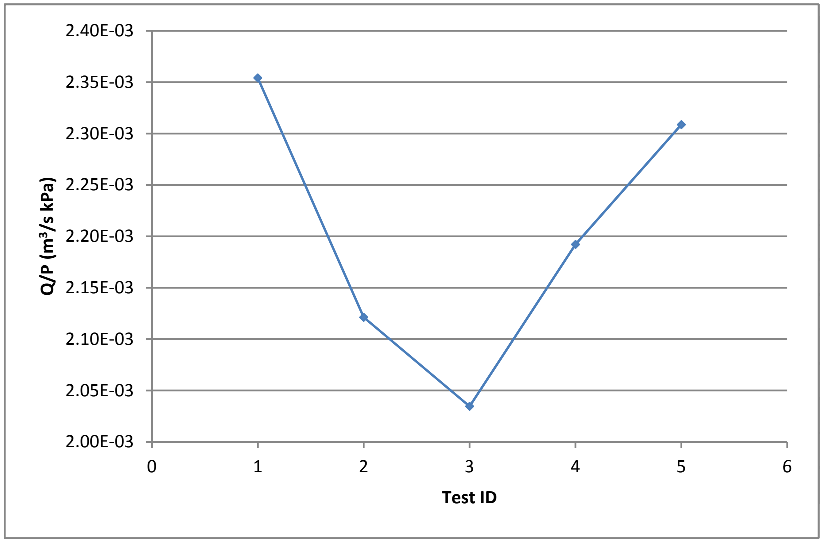
		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	***Initial Reading***	0.00	-1.00	-1.00	-0.75	-0.50	-0.50
	1	-0.75	-1.00	-0.75	-0.25	-0.50	-0.25
	2	0.00	0.00	0.00	0.25	0.25	0.75
	3	-0.25	0.00	0.00	0.25	0.25	0.25
	4	-0.50	-0.75	-1.00	-0.50	-0.50	-0.50
	5	-0.50	-0.50	-1.00	-0.75	-0.75	-0.50

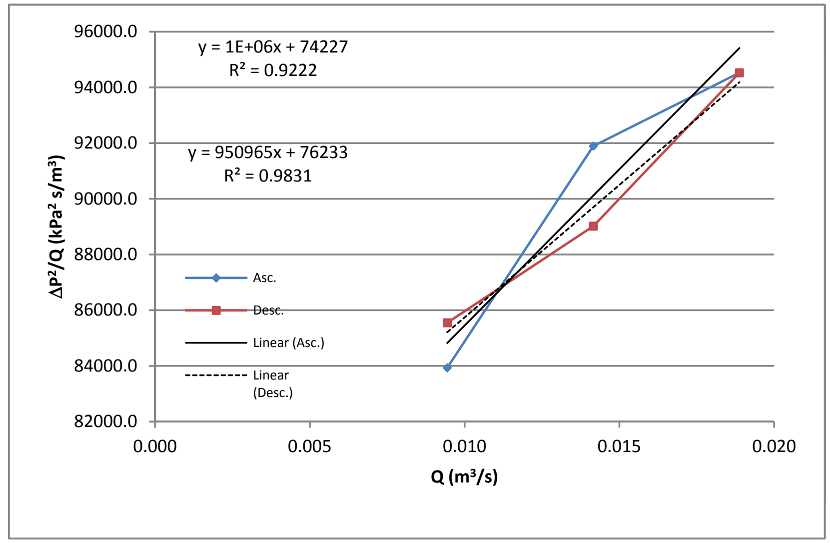
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	1	1.25	1.00	0.25	0.00	0.25	0.00	0.00
	2	1.25	1.50	0.25	0.25	0.25	0.00	0.00
	3	1.50	2.00	0.25	0.25	0.25	0.25	0.00
	4	1.25	1.50	0.25	0.00	0.00	0.00	-0.25
	5	1.00	1.25	0.00	-0.25	0.00	0.00	-0.25

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	1	0.25	0.25	0.75	0.00	0.25	0.25	-1.25
	2	0.50	0.50	0.50	0.00	0.00	0.00	-1.75
	3	0.50	0.50	0.50	0.00	-0.25	0.25	0.25
	4	0.25	0.25	0.50	-0.25	-0.25	-0.25	0.00
	5	0.00	0.00	0.00	-0.25	-0.50	0.00	0.00

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	1	-0.75	0.00	0.25	0.50	0.00	0.25
	2	0.00	1.00	1.00	1.00	0.75	1.25
	3	-0.25	1.00	1.00	1.00	0.75	0.75
	4	-0.50	0.25	0.00	0.25	0.00	0.00
	5	-0.50	0.50	0.00	0.00	-0.25	0.00





Q/P (m^3/s kPa)
2.35E-03
2.12E-03
2.03E-03
2.19E-03
2.31E-03

Packer Test:	**200909-C-ANG-4**
Client:	Syncrude Canada Ltd.

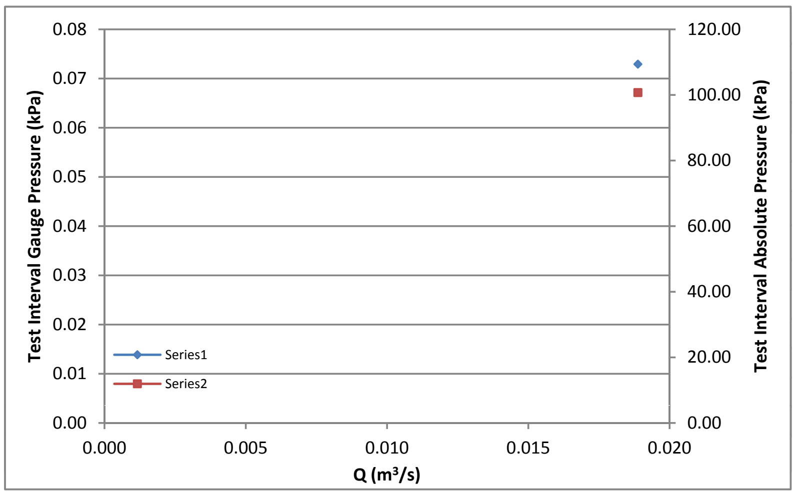
Test Date	20-Sep-09
Beginning Time	14:51:30
Ending Time	14:56:45
Test Interval Length (m)	1.38
Center of Test Interval (m)	4.32
Test Interval Temperature	11.5
Ambient Barometric Pressure (kPa)	100.8

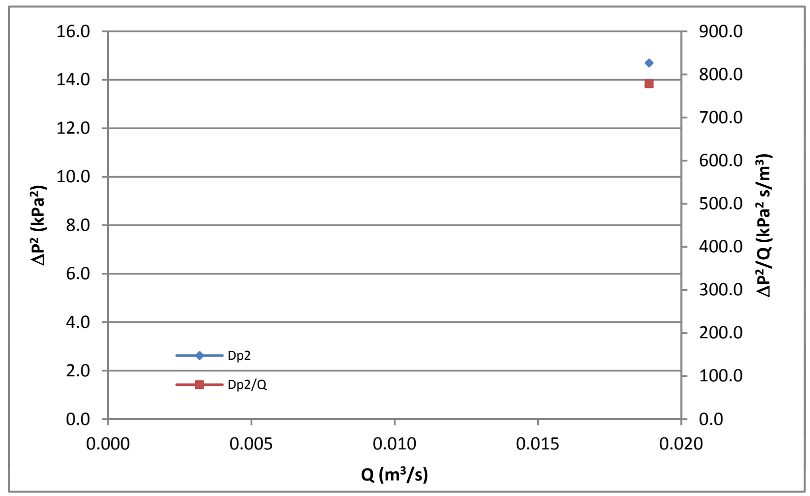
Measurement	**Depth** (m)
Top of Upper Packer	2.97
Top of Test Interval	3.83
Bottom of Test Interval	4.80
Bottom of Lower Packer	5.66

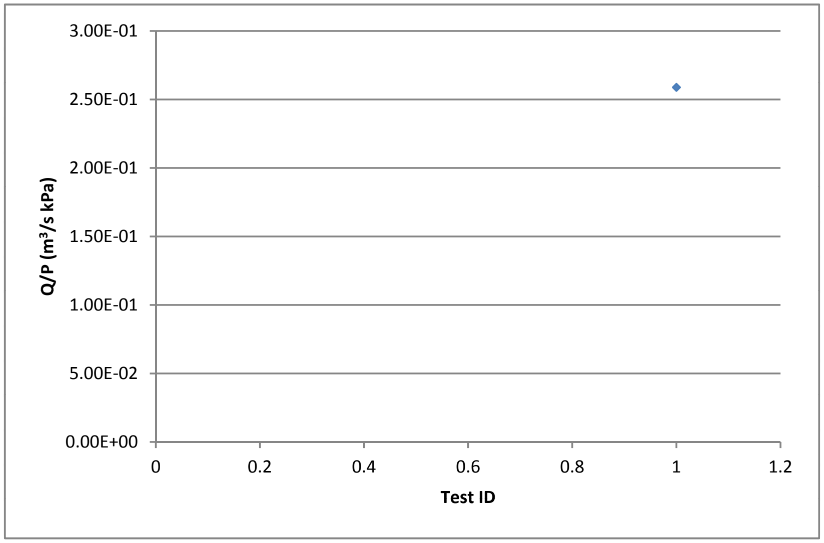
Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2 s/m^3$)
1	14:51:30	14:56:45	2400	0.019	2505.90	0.01	0.07	100.73	14.7	778.5
2	---	---	---	---	---	---	---	---	---	---
3	---	---	---	---	---	---	---	---	---	---
4	---	---	---	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---	---	---	---

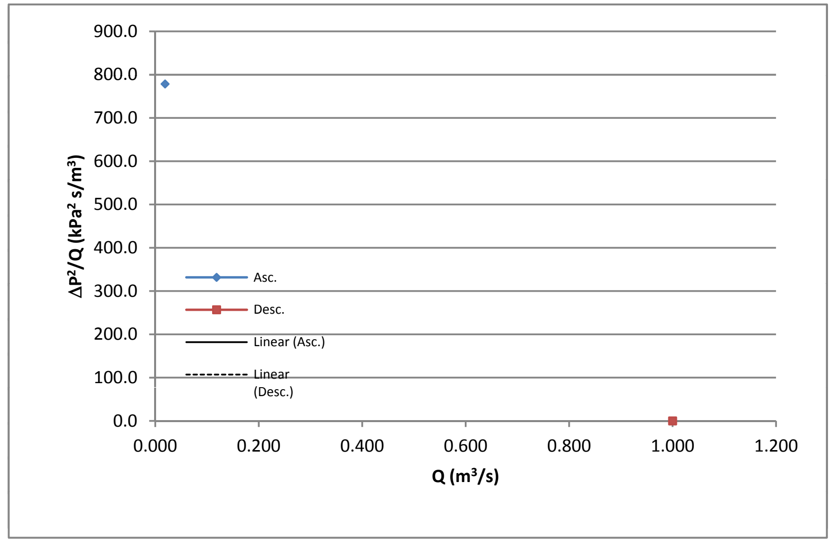
Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.









Q/P (m^3/s kPa)
2.59E-01

Packer Test: **200909-C-ANG-5**

Client: Syncrude Canada Ltd.

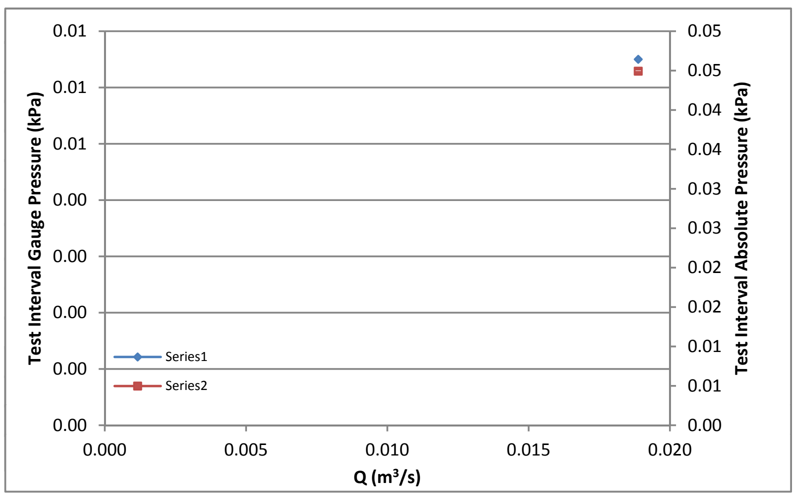
Test Date	20-Sep-09
Beginning Time	15:02:30
Ending Time	15:05:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	4.67
Test Interval Temperature	11.6
Ambient Barometric Pressure (kPa)	100.9

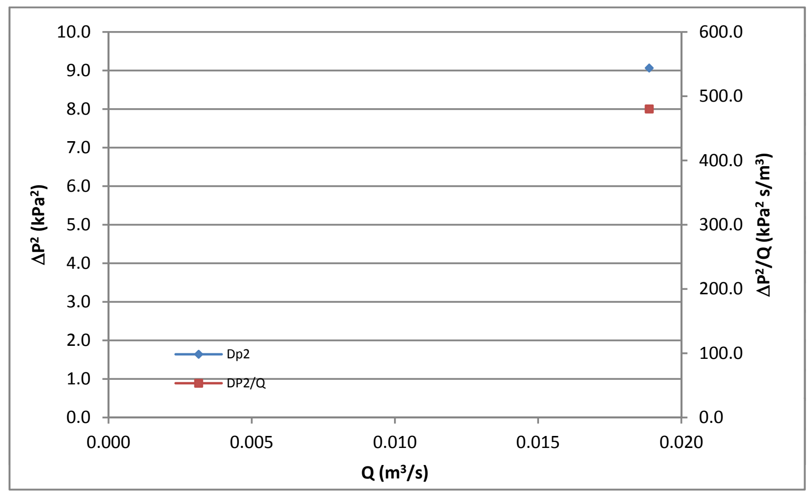
Measurement	**Depth** (m)
Top of Upper Packer	3.32
Top of Test Interval	4.18
Bottom of Test Interval	5.15
Bottom of Lower Packer	6.01

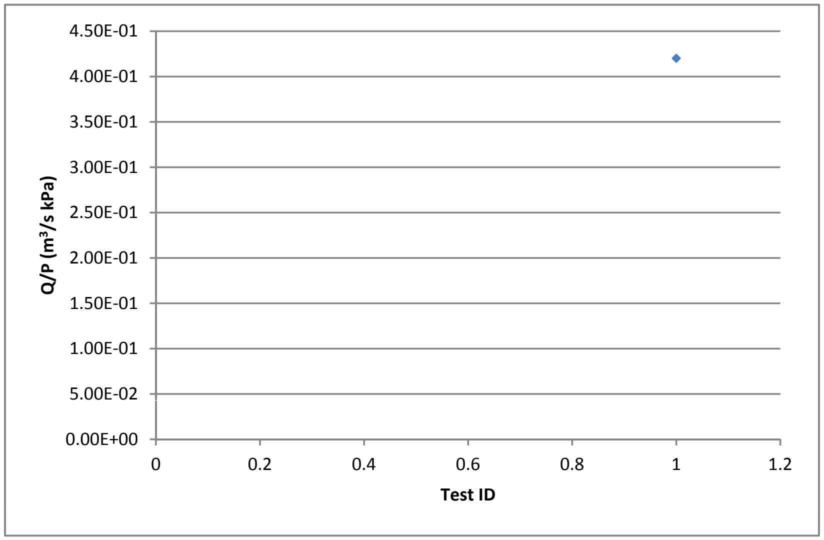
Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** (kPa^2 s/m^3)
1	15:02:30	15:05:00	2400	0.019	2506.44	0.01	0.04	100.86	9.1	480.2
2	---	---	---	---	---	---	---	---	---	---
3	---	---	---	---	---	---	---	---	---	---
4	---	---	---	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---	---	---	---

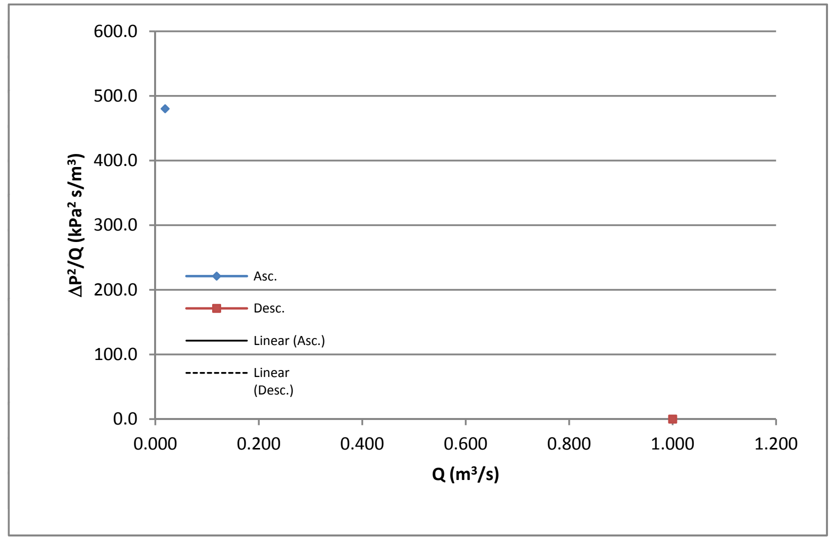
Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.









Q/P (m^3/s kPa)
4.20E-01

Packer Test:	**200909-C-ANG-6**
Client:	Syncrude Canada Ltd.

Test Date	20-Sep-09
Beginning Time	15:15:00
Ending Time	15:20:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	5.29
Test Interval Temperature	---
Ambient Barometric Pressure (kPa)	---

Measurement	**Depth** (m)
Top of Upper Packer	3.94
Top of Test Interval	4.80
Bottom of Test Interval	5.78
Bottom of Lower Packer	6.64

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\ s/m^3$)
1	---	---	---	---	---	---	---	---	---	---
2	---	---	---	---	---	---	---	---	---	---
3	---	---	---	---	---	---	---	---	---	---
4	---	---	---	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---	---	---	---

Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.

No Response at Maximum Measureable Flowrate

Packer Test:	**200909-C-ANG-7**
Client:	Syncrude Canada Ltd.

Test Date	20-Sep-09
Beginning Time	15:20:00
Ending Time	15:25:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	6.00
Test Interval Temperature	---
Ambient Barometric Pressure (kPa)	---

Measurement	**Depth** (m)
Top of Upper Packer	4.65
Top of Test Interval	5.51
Bottom of Test Interval	6.48
Bottom of Lower Packer	7.34

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\,s/m^3$)
1	---	---	---	---	---	---	---	---	---	---
2	---	---	---	---	---	---	---	---	---	---
3	---	---	---	---	---	---	---	---	---	---
4	---	---	---	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---	---	---	---

Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.

No Response at Maximum Measureable Flowrate

Packer Test:	**200909-C-ANG-8**
Client:	Syncrude Canada Ltd.

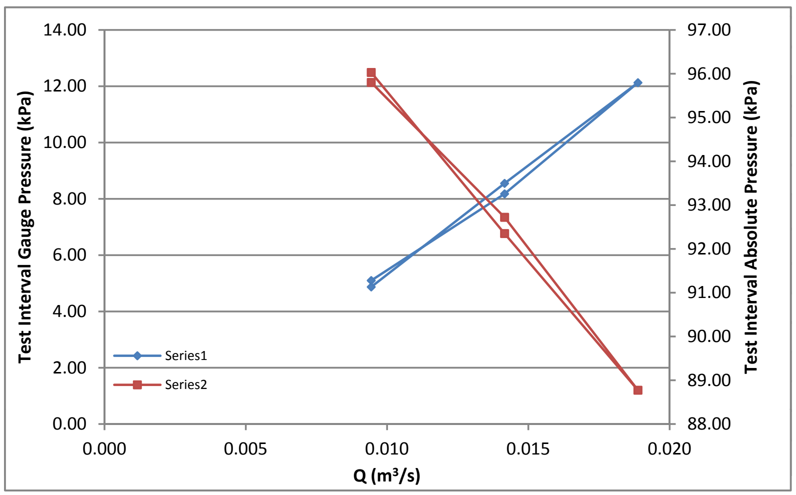
Test Date	20-Sep-09
Beginning Time	15:31:00
Ending Time	16:09:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	6.75
Test Interval Temperature	12.0
Ambient Barometric Pressure (kPa)	100.9

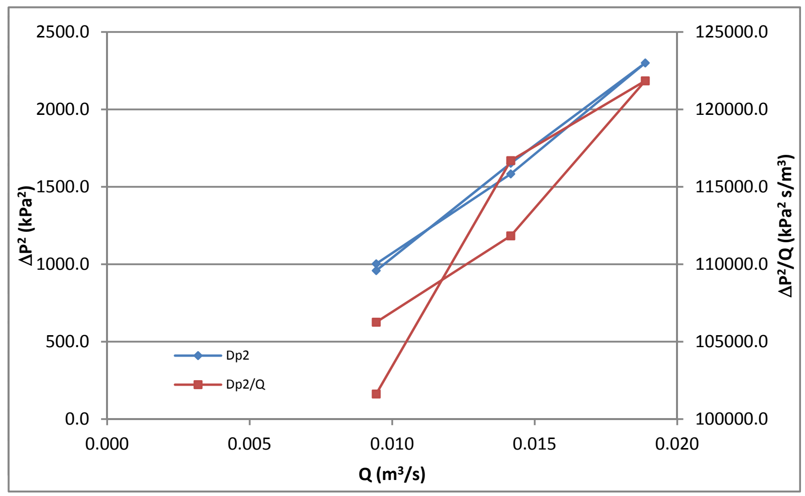
Measurement	**Depth** (m)
Top of Upper Packer	5.40
Top of Test Interval	6.26
Bottom of Test Interval	7.24
Bottom of Lower Packer	8.10

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2 s/m^3$)
1	15:35:45	15:42:15	1200	0.009	2413.35	0.70	4.87	96.03	959.2	101621.1
2	15:42:15	15:50:45	1800	0.014	2342.38	1.24	8.55	92.35	1652.2	116692.4
3	15:50:45	15:58:45	2400	0.019	2273.37	1.75	12.13	88.77	2300.2	121845.1
4	15:58:45	16:04:00	1800	0.014	2349.55	1.18	8.18	92.72	1583.4	111835.5
5	16:04:00	16:09:00	1200	0.009	2408.94	0.74	5.10	95.80	1003.0	106258.5

Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.





Packer Test: **200909-C-ANG-8**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
		Gas Port Number [Measurement Depth (m)]						
CMT 145	*Initial Reading*	*-2.00*	*0.00*	*-1.50*	*0.25*	*-0.25*	*-0.25*	*-0.50*
	1	-2.00	-0.25	-0.50	1.50	0.00	-0.25	-0.25
	2	-2.00	0.00	-0.50	3.00	1.00	0.25	-0.25
	3	-2.00	0.25	-0.50	3.50	1.00	0.00	-0.50
	4	-2.00	0.25	-0.50	2.50	0.50	-0.25	-0.75
	5	-2.00	0.00	-0.50	1.50	0.25	0.00	-0.50

		1 [2.0]	2 [4.0]	3 [6.0]	4 [8.0]	5 [12.0]	6 [14.0]	7 [16.0]
CMT 146	*Initial Reading*	*-1.00*	*-1.00*	*-1.50*	*0.00*	*-1.00*	*-1.25*	*0.50*
	1	-1.00	-0.50	-1.25	0.00	-1.00	-1.00	*-0.50*
	2	-1.00	-1.00	-1.25	0.00	-1.00	-1.25	*0.50*
	3	-1.00	-1.00	-1.00	0.25	-1.00	-1.25	*0.00*
	4	-1.00	-1.00	-1.25	0.00	-1.00	-1.25	*0.00*
	5	-1.00	-1.00	-1.25	0.00	-0.75	-1.25	*-0.50*

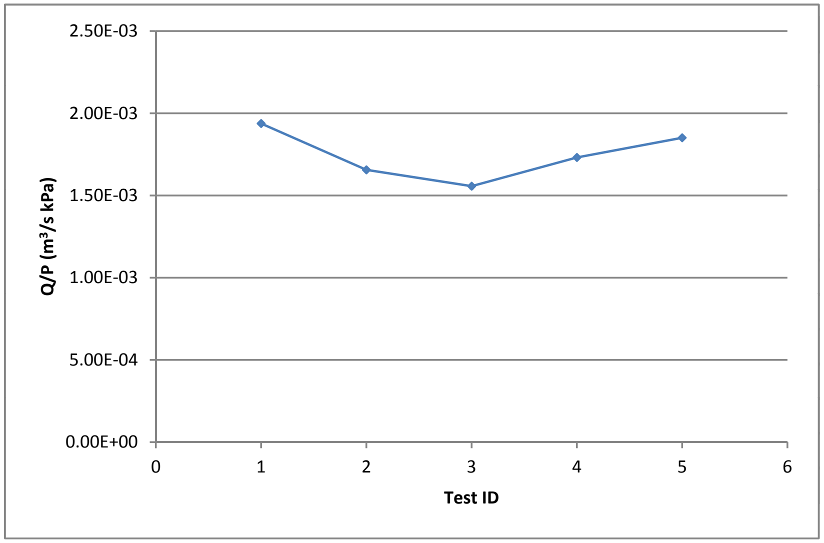
		1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
CMT 147	*Initial Reading*	---	---	---	---	---	---
	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---

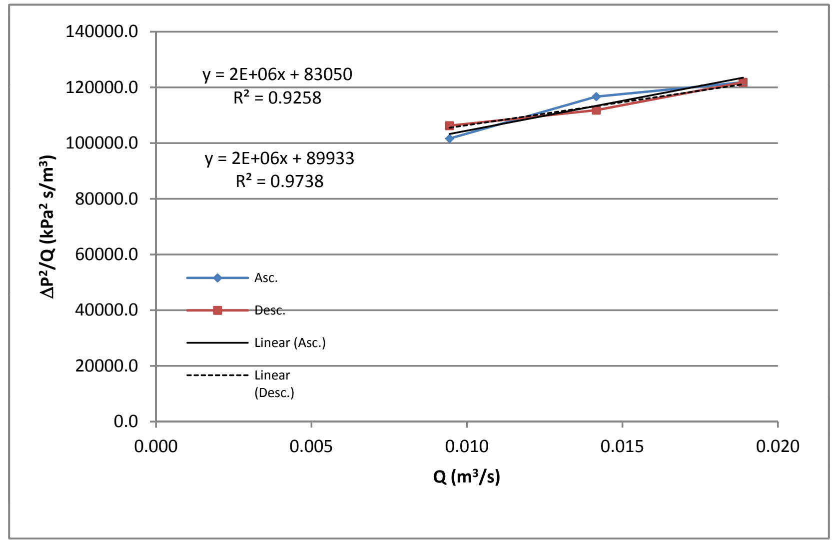
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	1 [1.0]	2 [3.0]	3 [5.0]	4 [7.0]	5 [11.0]	6 [13.0]	7 [15.0]
		Gas Port Number [Measurement Depth (m)]						
CMT 145	1	0.00	-0.25	1.00	1.25	0.25	0.00	0.25
	2	0.00	0.00	1.00	2.75	1.25	0.50	0.25
	3	0.00	0.25	1.00	3.25	1.25	0.25	0.00
	4	0.00	0.25	1.00	2.25	0.75	0.00	-0.25
	5	0.00	0.00	1.00	1.25	0.50	0.25	0.00

		1 [2.0]	2 [4.0]	3 [6.0]	4 [8.0]	5 [12.0]	6 [14.0]	7 [16.0]
CMT 146	1	0.00	0.50	0.25	0.00	0.00	0.25	-1.00
	2	0.00	0.00	0.25	0.00	0.00	0.00	0.00
	3	0.00	0.00	0.50	0.25	0.00	0.00	-0.50
	4	0.00	0.00	0.25	0.00	0.00	0.00	-0.50
	5	0.00	0.00	0.25	0.00	0.25	0.00	-1.00

		1 [0.5]	2 [1.0]	3 [2.0]	4 [3.0]	5 [5.0]	6 [6.0]
CMT 147	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---





Q/P (m^3/s kPa)
1.94E-03
1.66E-03
1.56E-03
1.73E-03
1.85E-03

Packer Test:	**200909-C-ANG-9**
Client:	Syncrude Canada Ltd.

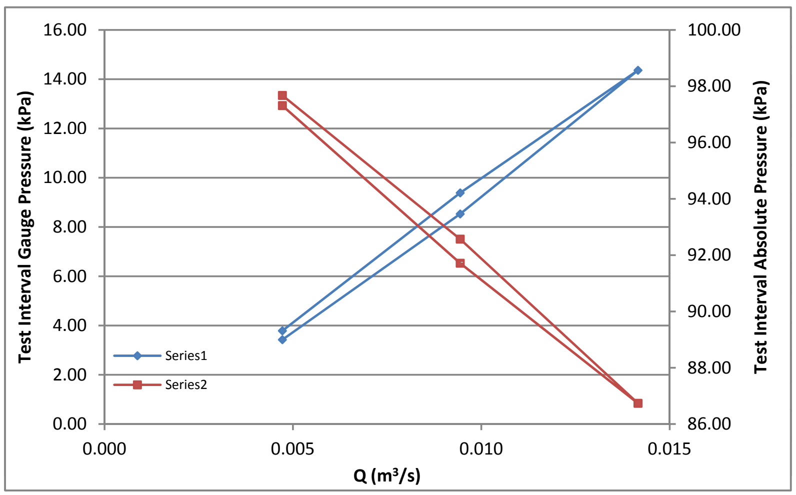
Test Date	20-Sep-09
Beginning Time	16:52:45
Ending Time	17:34:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	7.73
Test Interval Temperature	12.7
Ambient Barometric Pressure (kPa)	101.1

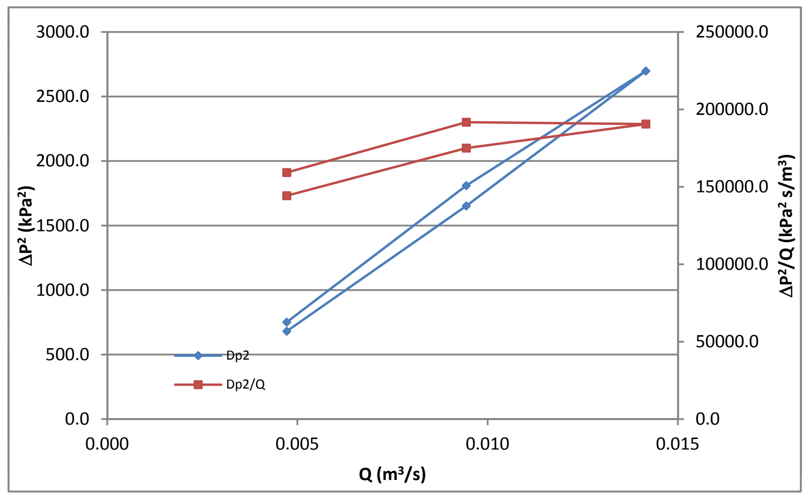
Measurement	**Depth** (m)
Top of Upper Packer	6.38
Top of Test Interval	7.24
Bottom of Test Interval	8.22
Bottom of Lower Packer	9.08

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\ s/m^3$)
1	16:56:30	17:04:15	600	0.005	2434.25	0.55	3.79	97.31	751.4	159216.6
2	17:04:15	17:10:45	1200	0.009	2326.25	1.36	9.39	91.71	1809.7	191726.5
3	17:10:45	17:20:15	1800	0.014	2230.25	2.08	14.36	86.74	2697.8	190541.1
4	17:20:15	17:27:15	1200	0.009	2342.76	1.23	8.53	92.57	1652.0	175017.0
5	17:27:15	17:34:00	600	0.005	2441.23	0.50	3.43	97.67	680.9	144265.6

Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.





Packer Test: **200909-C-ANG-9**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	***Initial Reading***	*-2.00*	*-1.00*	*-2.00*	*-1.00*	*-1.00*	*-1.00*	*-2.00*
	1	-2.00	-0.75	-1.50	1.00	-0.50	-0.75	-1.00
	2	-2.00	-0.50	-2.00	3.00	0.00	-0.50	-1.00
	3	-2.00	-0.50	-2.00	5.50	0.50	-0.75	-2.00
	4	-2.00	-1.00	-2.00	3.00	0.00	-1.00	-2.00
	5	-2.00	-1.00	-2.50	1.00	-0.50	-1.50	-2.00

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	***Initial Reading***	*-2.00*	*-2.00*	*-2.50*	*-2.00*	*-2.00*	*-2.50*	*1.00*
	1	-2.00	-2.00	-1.50	-1.00	*-2.00*	*-2.50*	*1.00*
	2	*-2.00*	*-2.00*	*-1.50*	*-1.00*	*-1.75*	*-2.50*	*1.75*
	3	-2.00	-2.00	-1.50	-0.75	-1.75	-2.50	*2.00*
	4	*-2.00*	*-2.00*	*-2.00*	*-0.50*	*-2.00*	*-2.25*	*1.50*
	5	-2.00	-2.00	-2.00	-1.00	-1.75	-2.50	*2.00*

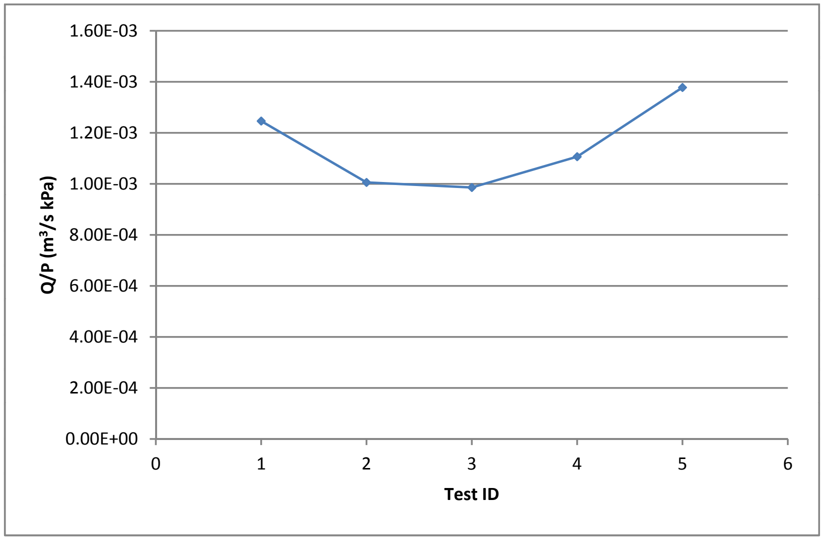
		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	***Initial Reading***	---	---	---	---	---	---
	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---

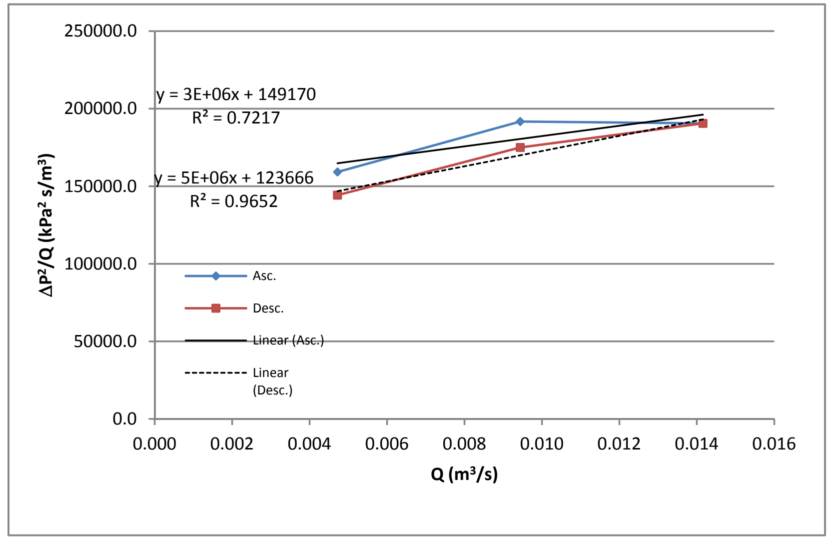
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	1	0.00	0.25	0.50	2.00	0.50	0.25	1.00
	2	0.00	0.50	0.00	4.00	1.00	0.50	1.00
	3	0.00	0.50	0.00	6.50	1.50	0.25	0.00
	4	0.00	0.00	0.00	4.00	1.00	0.00	0.00
	5	0.00	0.00	-0.50	2.00	0.50	-0.50	0.00

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	1	0.00	0.00	1.00	1.00	0.00	0.00	0.00
	2	0.00	0.00	1.00	1.00	0.25	0.00	0.75
	3	0.00	0.00	1.00	1.25	0.25	0.00	1.00
	4	0.00	0.00	0.50	1.50	0.00	0.25	0.50
	5	0.00	0.00	0.50	1.00	0.25	0.00	1.00

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---





Q/P (m^3/s kPa)
1.25E-03
1.01E-03
9.86E-04
1.11E-03
1.38E-03

Packer Test:	**200909-C-ANG-10**
Client:	Syncrude Canada Ltd.

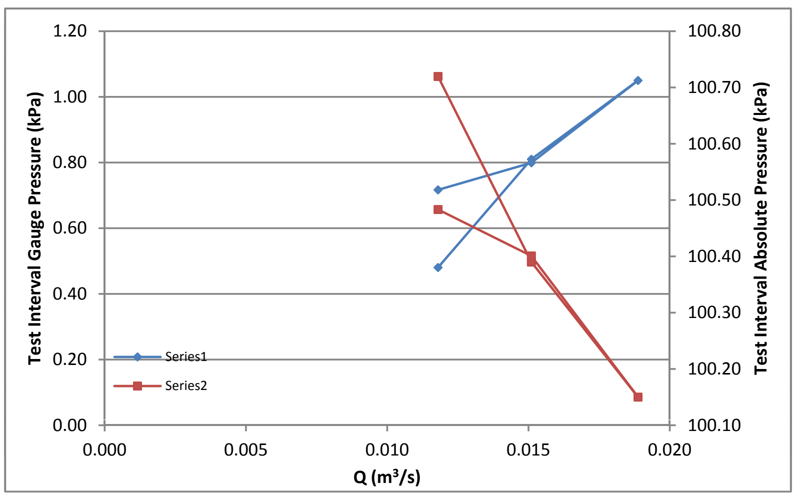
Test Date	20-Sep-09
Beginning Time	17:40:45
Ending Time	18:16:15
Test Interval Length (m)	1.38
Center of Test Interval (m)	8.71
Test Interval Temperature	13.6
Ambient Barometric Pressure (kPa)	101.2

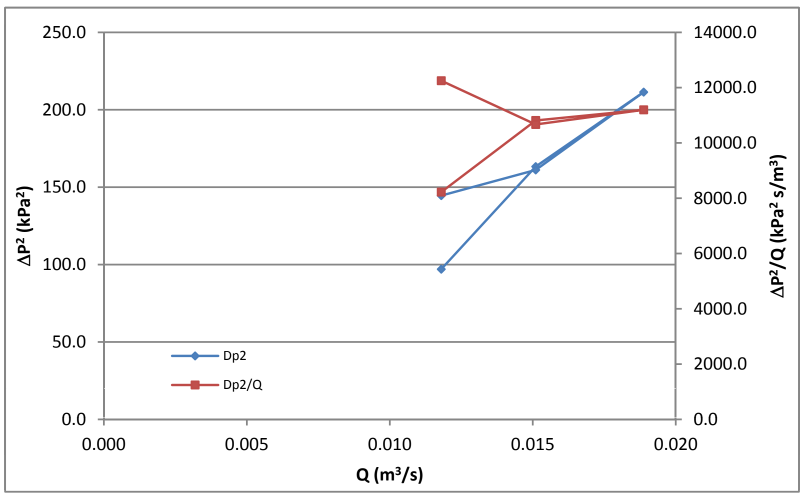
Measurement	**Depth** (m)
Top of Upper Packer	7.36
Top of Test Interval	8.22
Bottom of Test Interval	9.19
Bottom of Lower Packer	10.05

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\,s/m^3$)
1	17:42:45	17:49:15	1500	0.012	2498.04	0.07	0.48	100.72	97.0	8222.4
2	17:49:15	17:55:30	1920	0.015	2491.68	0.12	0.81	100.39	163.3	10813.0
3	17:55:30	18:05:00	2400	0.019	2487.05	0.15	1.05	100.15	211.4	11198.6
4	18:05:00	18:09:30	1920	0.015	2491.89	0.12	0.80	100.40	161.1	10669.0
5	18:09:30	18:16:15	1500	0.012	2493.48	0.10	0.72	100.48	144.6	12252.0

Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.





Packer Test: **200909-C-ANG-10**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	***Initial Reading***	*-2.00*	*-1.00*	*-2.00*	*-1.00*	*-1.00*	*-1.00*	*-2.00*
	1	-2.00	-0.50	-2.00	3.00	2.00	-0.50	-1.25
	2	-2.00	-0.50	-1.75	3.50	2.50	-0.50	-1.50
	3	-2.00	-0.50	-2.00	4.00	2.75	0.00	-1.00
	4	-2.00	-0.50	-2.00	3.50	2.50	0.00	-1.00
	5	-2.00	-0.50	-2.00	3.00	2.00	-0.50	-1.00

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	***Initial Reading***	*-2.00*	*-2.00*	*-2.50*	*-2.00*	*-2.00*	*-2.50*	*1.00*
	1	-2.00	-2.00	-2.00	0.75	-1.00	-2.25	1.00
	2	-2.50	-1.50	-1.50	1.50	0.50	-2.00	0.75
	3	-2.50	-2.00	-1.75	2.00	-1.00	-2.00	1.75
	4	-1.75	-1.50	-1.50	1.50	-1.00	-2.00	1.00
	5	-2.00	-2.00	-1.75	0.75	-1.00	-2.00	1.00

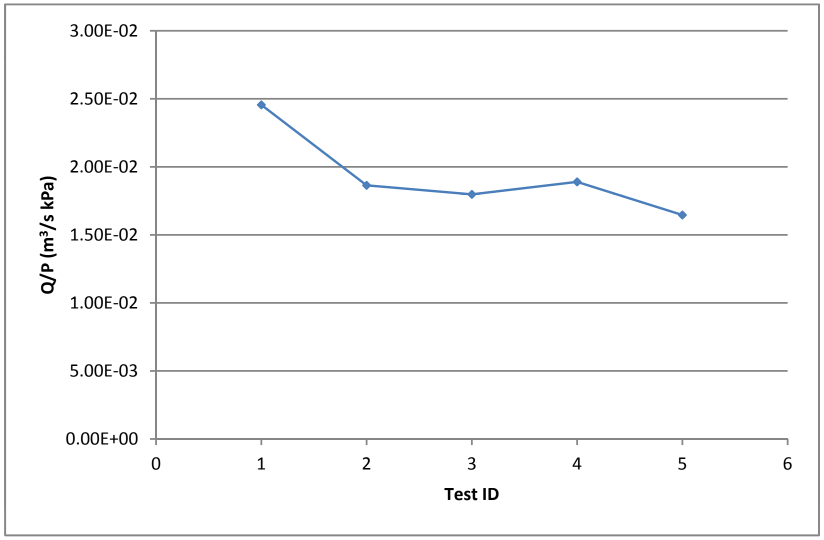
		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	***Initial Reading***	---	---	---	---	---	---
	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---

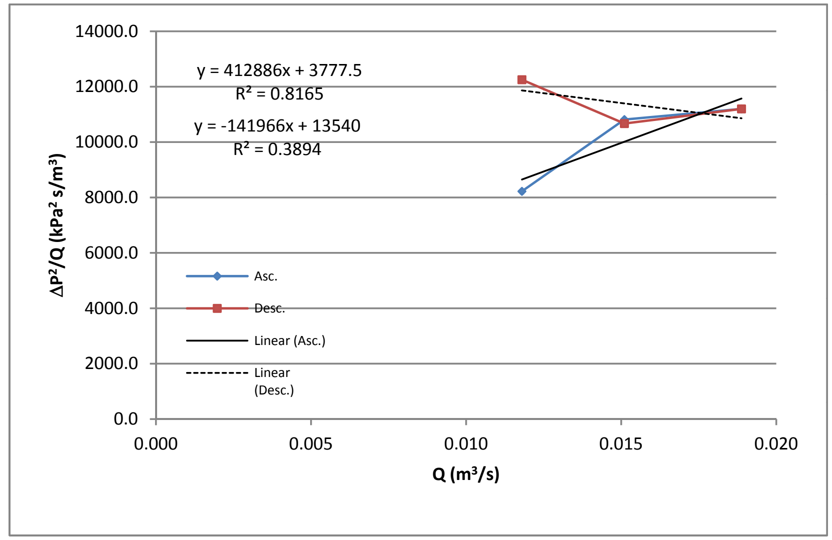
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	1	0.00	0.50	0.00	4.00	3.00	0.50	0.75
	2	0.00	0.50	0.25	4.50	3.50	0.50	0.50
	3	0.00	0.50	0.00	5.00	3.75	1.00	1.00
	4	0.00	0.50	0.00	4.50	3.50	1.00	1.00
	5	0.00	0.50	0.00	4.00	3.00	0.50	1.00

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	1	0.00	0.00	0.50	2.75	1.00	0.25	0.00
	2	-0.50	0.50	1.00	3.50	2.50	0.50	-0.25
	3	-0.50	0.00	0.75	4.00	1.00	0.50	0.75
	4	0.25	0.50	1.00	3.50	1.00	0.50	0.00
	5	0.00	0.00	0.75	2.75	1.00	0.50	0.00

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---





Q/P (m^3/s kPa)
2.46E-02
1.86E-02
1.80E-02
1.89E-02
1.65E-02

Packer Test:	**210909-C-ANG-1**
Client:	Syncrude Canada Ltd.

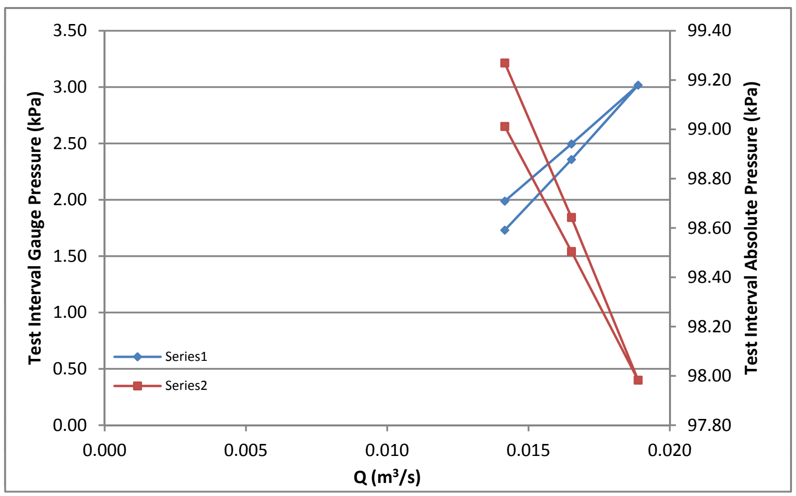
Test Date	21-Sep-09
Beginning Time	13:07:45
Ending Time	13:47:45
Test Interval Length (m)	1.38
Center of Test Interval (m)	6.40
Test Interval Temperature	12.3
Ambient Barometric Pressure (kPa)	101.0

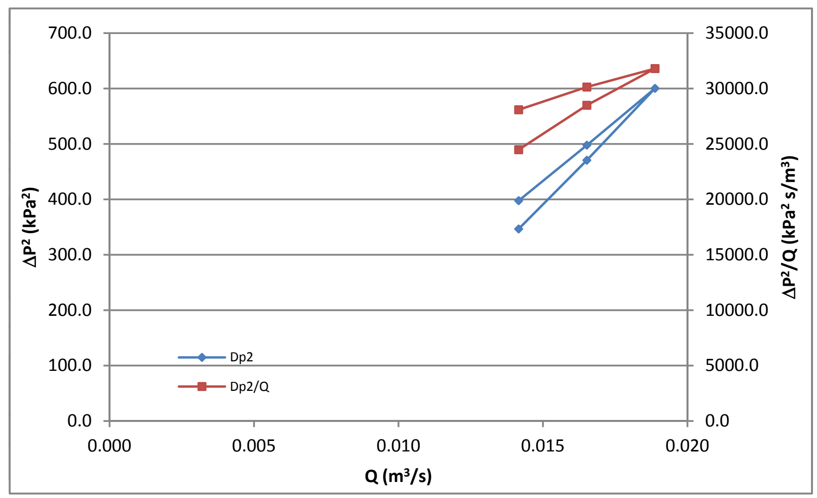
Measurement	**Depth** (m)
Top of Upper Packer	5.05
Top of Test Interval	5.91
Bottom of Test Interval	6.89
Bottom of Lower Packer	7.75

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\ s/m^3$)
1	13:11:45	13:21:15	1800	0.014	2473.92	0.25	1.73	99.27	346.6	24480.0
2	13:21:15	13:27:15	2100	0.017	2461.83	0.34	2.36	98.64	470.6	28490.6
3	13:27:15	13:34:30	2400	0.019	2449.10	0.44	3.02	97.98	600.4	31802.5
4	13:34:30	13:42:00	2100	0.017	2459.17	0.36	2.50	98.50	497.8	30136.9
5	13:42:00	13:47:45	1800	0.014	2468.95	0.29	1.99	99.01	397.6	28085.6

Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.





Packer Test: **210909-C-ANG-1**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	***Initial Reading***	*-1.00*	*-0.50*	*-1.50*	*-0.25*	*-0.50*	*-0.75*	*-0.75*
	1	-0.50	0.00	-1.00	1.50	0.25	-0.75	-0.75
	2	-0.50	0.50	-0.50	2.00	0.75	0.00	-0.50
	3	-1.00	0.00	-0.50	2.75	1.00	-0.50	-0.50
	4	-0.75	0.00	-0.50	2.00	0.50	-0.25	-0.25
	5	-1.00	0.00	-0.50	1.50	0.25	-0.50	-0.50

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	***Initial Reading***	*-1.00*	*-1.50*	*-1.00*	*-0.50*	*-0.75*	*-1.75*	*-1.00*
	1	-1.00	-1.50	-1.00	-0.50	-0.50	-1.50	*-2.00*
	2	-1.00	-1.50	-1.00	-0.50	-0.75	-1.50	*-1.50*
	3	-1.00	-1.50	-1.00	-0.50	-0.75	-1.50	*-1.50*
	4	-1.00	-1.50	-1.00	-0.50	-0.75	-1.50	*-1.50*
	5	-1.00	-1.50	-1.00	-0.50	-1.00	-1.50	*-1.25*

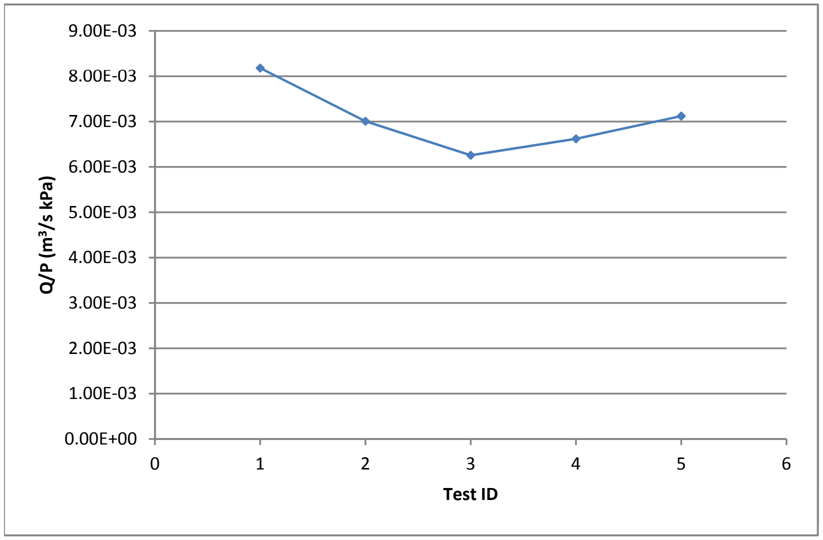
		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	***Initial Reading***	---	---	---	---	---	---
	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---

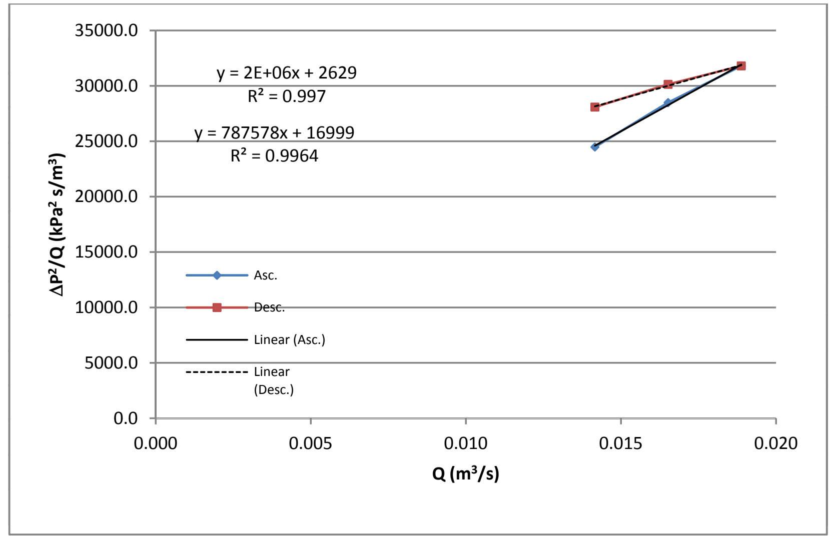
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	1	0.50	0.50	0.50	1.75	0.75	0.00	0.00
	2	0.50	1.00	1.00	2.25	1.25	0.75	0.25
	3	0.00	0.50	1.00	3.00	1.50	0.25	0.25
	4	0.25	0.50	1.00	2.25	1.00	0.50	0.50
	5	0.00	0.50	1.00	1.75	0.75	0.25	0.25

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	1	0.00	0.00	0.00	0.00	0.25	0.25	-1.00
	2	0.00	0.00	0.00	0.00	0.00	0.25	-0.50
	3	0.00	0.00	0.00	0.00	0.00	0.25	-0.50
	4	0.00	0.00	0.00	0.00	0.00	0.25	-0.50
	5	0.00	0.00	0.00	0.00	-0.25	0.25	-0.25

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---





Q/P (m^3/s kPa)
8.18E-03
7.01E-03
6.26E-03
6.62E-03
7.12E-03

Packer Test:	**210909-C-ANG-2**
Client:	Syncrude Canada Ltd.

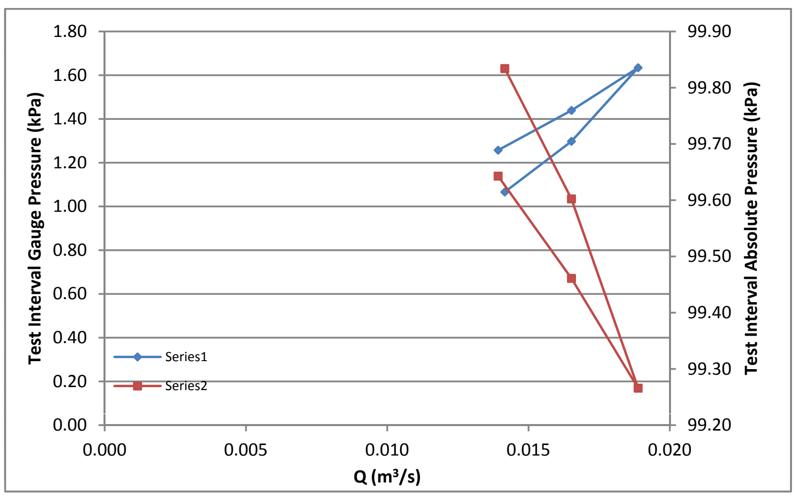
Test Date	21-Sep-09
Beginning Time	13:55:30
Ending Time	14:38:15
Test Interval Length (m)	1.38
Center of Test Interval (m)	9.68
Test Interval Temperature	14.1
Ambient Barometric Pressure (kPa)	100.9

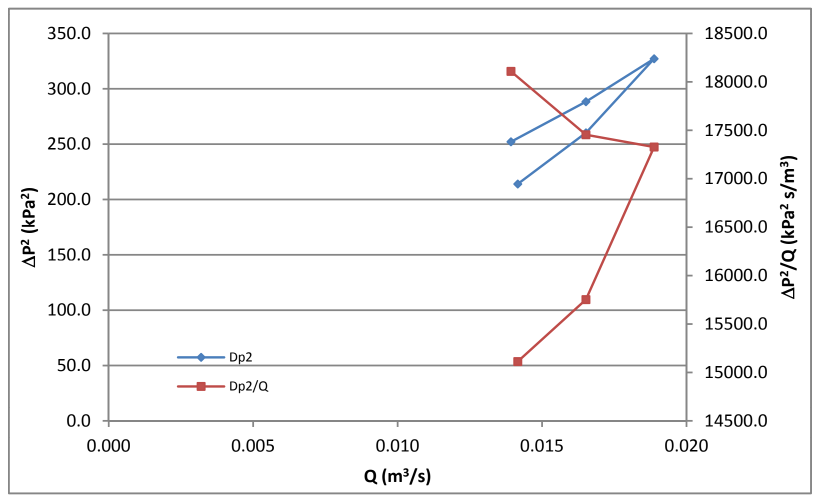
Measurement	**Depth** (m)
Top of Upper Packer	8.33
Top of Test Interval	9.19
Bottom of Test Interval	10.17
Bottom of Lower Packer	11.03

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2 s/m^3$)
1	13:59:15	14:08:30	1770	0.014	2483.06	0.18	1.26	99.64	252.1	18108.2
2	14:08:30	14:16:15	2100	0.017	2479.55	0.21	1.44	99.46	288.3	17454.1
3	14:16:15	14:22:00	2400	0.019	2475.78	0.24	1.63	99.27	327.1	17327.3
4	14:22:00	14:27:30	2100	0.017	2482.27	0.19	1.30	99.60	260.2	15752.2
5	14:27:30	14:38:15	1800	0.014	2486.74	0.15	1.07	99.83	214.0	15112.5

Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.





Packer Test: **210909-C-ANG-2**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	***Initial Reading***	*-1.00*	*-0.50*	*-1.50*	*-0.25*	*-0.50*	*-0.75*	*-0.75*
	1	-0.50	-0.25	-1.00	3.00	2.25	1.00	0.00
	2	-0.75	0.00	-1.00	3.50	2.75	1.00	0.25
	3	-1.00	0.00	-1.00	4.00	3.25	1.25	0.00
	4	-1.00	0.00	-1.00	3.50	3.00	1.00	0.00
	5	-1.00	0.00	-1.00	3.00	2.50	1.00	0.00

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	***Initial Reading***	*-1.00*	*-1.50*	*-1.00*	*-0.50*	*-0.75*	*-1.75*	*-1.00*
	1	-1.00	-1.50	-1.25	0.75	0.00	-1.00	-1.00
	2	-1.00	-1.50	-1.50	1.00	0.50	-1.00	-1.50
	3	-1.00	-1.50	-1.00	1.25	0.75	-1.00	-1.25
	4	-1.00	-1.50	-1.00	1.00	0.25	-1.00	-1.50
	5	-1.00	-1.50	-1.00	0.75	0.00	-1.50	0.00

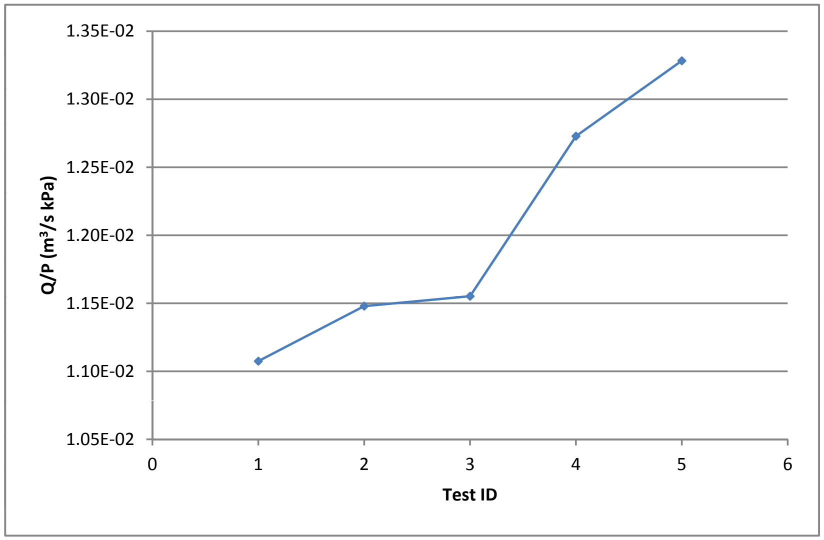
		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	***Initial Reading***	---	---	---	---	---	---
	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---

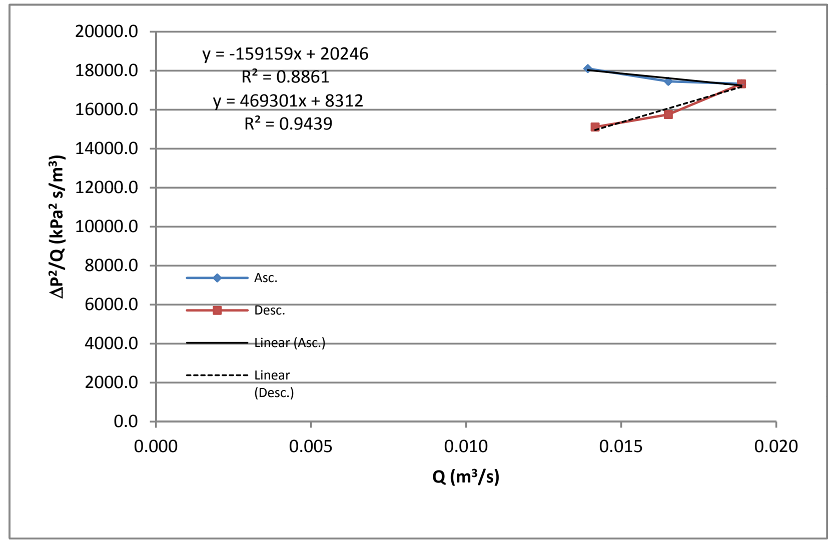
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	1	0.50	0.25	0.50	3.25	2.75	1.75	0.75
	2	0.25	0.50	0.50	3.75	3.25	1.75	1.00
	3	0.00	0.50	0.50	4.25	3.75	2.00	0.75
	4	0.00	0.50	0.50	3.75	3.50	1.75	0.75
	5	0.00	0.50	0.50	3.25	3.00	1.75	0.75

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	1	0.00	0.00	-0.25	1.25	0.75	0.75	0.00
	2	0.00	0.00	-0.50	1.50	1.25	0.75	-0.50
	3	0.00	0.00	0.00	1.75	1.50	0.75	-0.25
	4	0.00	0.00	0.00	1.50	1.00	0.75	-0.50
	5	0.00	0.00	0.00	1.25	0.75	0.25	1.00

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---





Q/P (m^3/s kPa)
1.11E-02
1.15E-02
1.16E-02
1.27E-02
1.33E-02

Packer Test:	**210909-C-ANG-3**
Client:	Syncrude Canada Ltd.

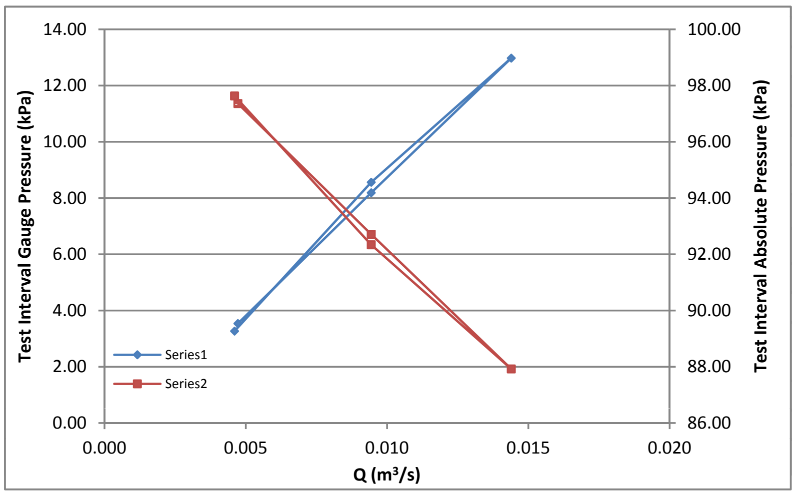
Test Date	21-Sep-09
Beginning Time	14:46:00
Ending Time	15:33:45
Test Interval Length (m)	1.38
Center of Test Interval (m)	10.66
Test Interval Temperature	13.4
Ambient Barometric Pressure (kPa)	100.9

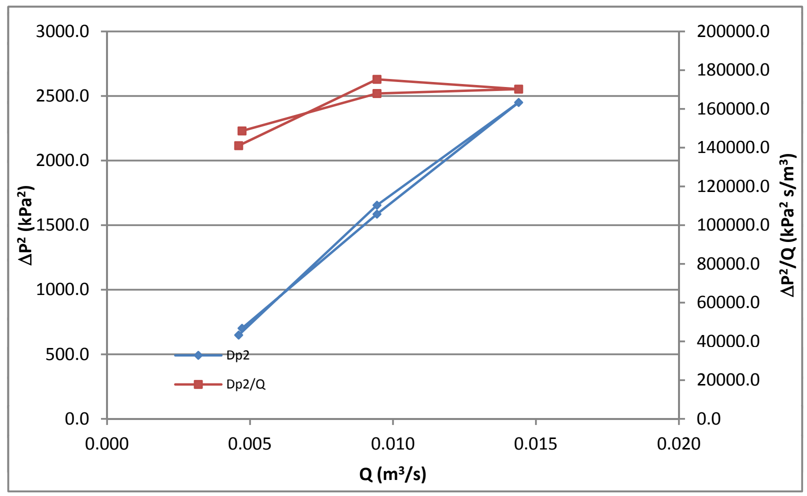
Measurement	**Depth** (m)
Top of Upper Packer	9.31
Top of Test Interval	10.17
Bottom of Test Interval	11.14
Bottom of Lower Packer	12.00

Flow Rate ID	**Begin Time** (HH:MM:SS)	**Ending Time** (HH:MM:SS)	**Pump Rate** (ft^3/hr)	**Pump Rate** (m^3/s)	**Transducer Output** (mV)	**Gauge Pressure** (psi)	**Gauge Pressure** (kPa)	**Absolute Pressure** (kPa)	**ΔP^2** (kPa^2)	**$\Delta P^2/Q$** ($kPa^2\ s/m^3$)
1	14:55:45	15:04:15	585	0.005	2444.25	0.47	3.27	97.63	649.0	141030.8
2	15:04:15	15:11:00	1200	0.009	2342.15	1.24	8.56	92.34	1654.4	175276.2
3	15:12:30	15:21:45	1830	0.014	2257.00	1.88	12.98	87.92	2450.1	170211.6
4	15:21:45	15:28:00	1200	0.009	2349.35	1.18	8.19	92.71	1585.4	167959.2
5	15:28:00	15:33:45	600	0.005	2439.05	0.51	3.54	97.36	701.5	148647.4

Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.





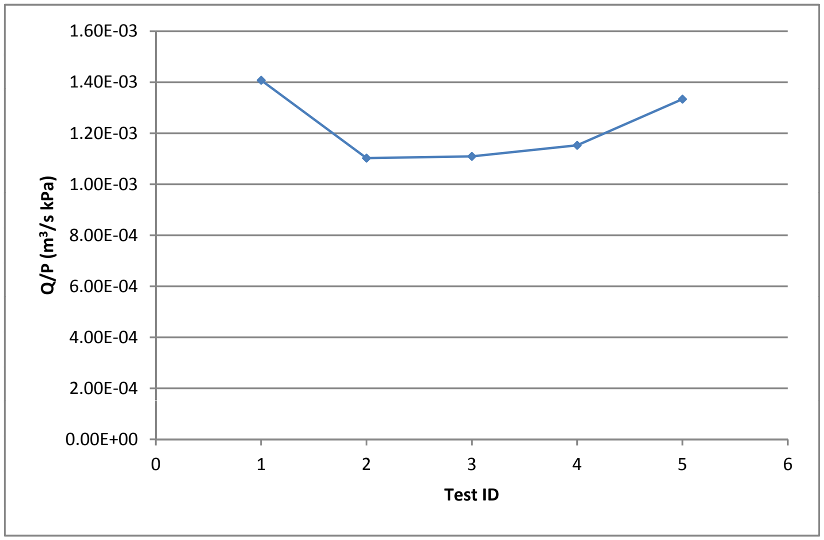
Packer Test: **210909-C-ANG-3**

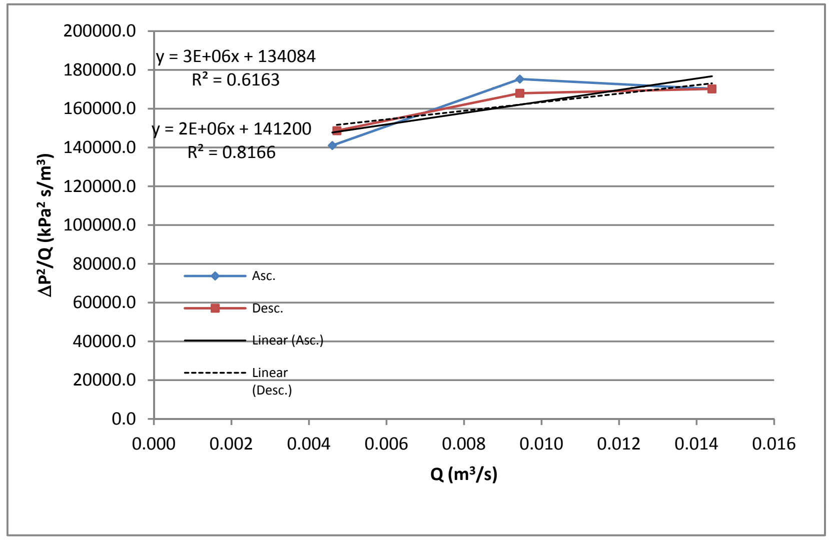
Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	***Initial Reading***	*-1.00*	*-0.50*	*-1.50*	*-0.25*	*-0.50*	*-0.75*	*-0.75*
	1	-1.00	0.00	-1.00	0.50	2.00	1.00	0.00
	2	-1.00	0.00	-1.00	1.25	3.00	1.50	0.50
	3	-1.00	0.00	-1.00	1.50	4.00	1.75	0.50
	4	-1.00	0.00	-1.00	0.75	3.00	1.50	0.50
	5	-1.00	0.00	-1.00	0.50	2.00	1.00	0.00
		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	***Initial Reading***	*-1.00*	*-1.50*	*-1.00*	*-0.50*	*-0.75*	*-1.75*	*-1.00*
	1	-1.00	-1.50	-1.00	-0.50	-0.50	-1.25	0.00
	2	-1.00	-1.50	-1.00	-0.50	0.00	-1.25	0.25
	3	-1.00	-1.50	-1.00	0.50	0.75	-1.00	0.00
	4	-1.00	-1.50	-1.00	0.25	0.00	-1.00	0.00
	5	-1.00	-1.50	-1.25	0.00	-0.50	-1.00	0.00
		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**	
CMT 147	***Initial Reading***	---	---	---	---	---	---	
	1	---	---	---	---	---	---	
	2	---	---	---	---	---	---	
	3	---	---	---	---	---	---	
	4	---	---	---	---	---	---	
	5	---	---	---	---	---	---	

Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	1	0.00	0.50	0.50	0.75	2.50	1.75	0.75
	2	0.00	0.50	0.50	1.50	3.50	2.25	1.25
	3	0.00	0.50	0.50	1.75	4.50	2.50	1.25
	4	0.00	0.50	0.50	1.00	3.50	2.25	1.25
	5	0.00	0.50	0.50	0.75	2.50	1.75	0.75
		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	1	0.00	0.00	0.00	0.00	0.25	0.50	1.00
	2	0.00	0.00	0.00	0.00	0.75	0.50	1.25
	3	0.00	0.00	0.00	1.00	1.50	0.75	1.00
	4	0.00	0.00	0.00	0.75	0.75	0.75	1.00
	5	0.00	0.00	-0.25	0.50	0.25	0.75	1.00
		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**	
CMT 147	1	---	---	---	---	---	---	
	2	---	---	---	---	---	---	
	3	---	---	---	---	---	---	
	4	---	---	---	---	---	---	
	5	---	---	---	---	---	---	





Q/P (m^3/s kPa)
1.41E-03
1.10E-03
1.11E-03
1.15E-03
1.33E-03

Packer Test:	210909-C-ANG-4
Client:	Syncrude Canada Ltd.

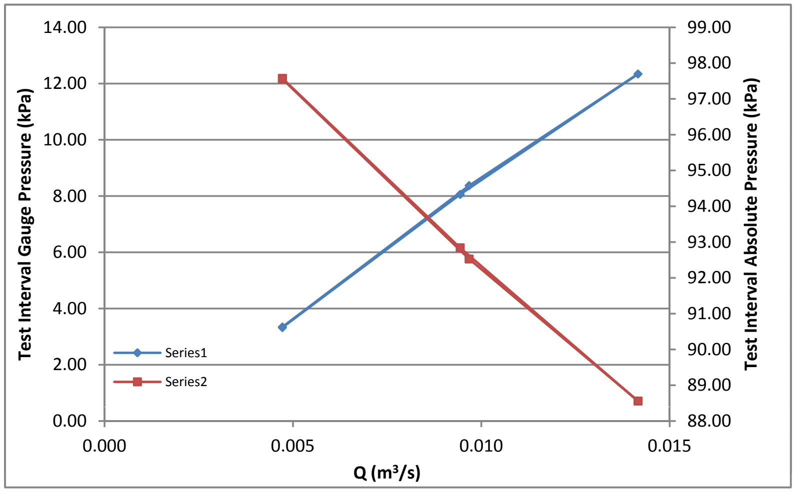
Test Date	21-Sep-09
Beginning Time	15:39:30
Ending Time	16:01:00
Test Interval Length (m)	1.38
Center of Test Interval (m)	11.17
Test Interval Temperature	13.6
Ambient Barometric Pressure (kPa)	100.9

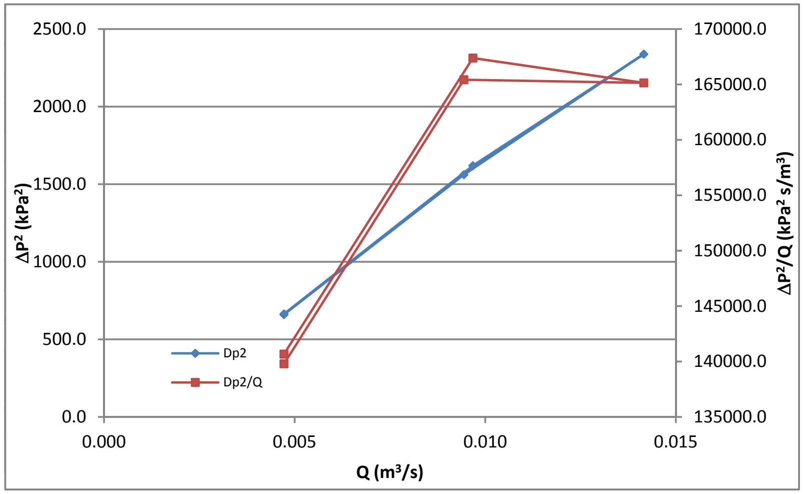
Measurement	Depth (m)
Top of Upper Packer	9.82
Top of Test Interval	10.68
Bottom of Test Interval	11.66
Bottom of Lower Packer	12.52

Flow Rate ID	Begin Time (HH:MM:SS)	Ending Time (HH:MM:SS)	Pump Rate (ft^3/hr)	Pump Rate (m^3/s)	Transducer Output (mV)	Gauge Pressure (psi)	Gauge Pressure (kPa)	Absolute Pressure (kPa)	ΔP^2 (kPa^2)	$\Delta P^2/Q$ ($kPa^2\ s/m^3$)
1	15:43:00	15:48:45	600	0.005	2442.77	0.48	3.35	97.55	663.9	140672.2
2	15:48:45	15:52:00	1230	0.010	2345.80	1.21	8.37	92.53	1619.4	167383.9
3	15:52:00	15:56:30	1800	0.014	2269.24	1.79	12.34	88.56	2338.2	165142.5
4	15:56:30	15:58:15	1200	0.009	2351.83	1.17	8.06	92.84	1561.5	165426.3
5	15:58:15	16:01:00	600	0.005	2443.18	0.48	3.32	97.58	659.8	139795.4

Notes:

For the angular boreholes the packer test interval depths have been referenced to a vertical distance below the surface of the sulphur block.





Packer Test: **210909-C-ANG-4**

Raw Data - Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	***Initial Reading***	*-1.00*	*-0.50*	*-1.50*	*-0.25*	*-0.50*	*-0.75*	*-0.75*
	1	-1.00	0.00	-1.00	0.25	1.50	1.00	0.00
	2	-1.00	0.00	-1.00	0.75	2.50	1.50	0.00
	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	***Initial Reading***	*-1.00*	*-1.50*	*-1.00*	*-0.50*	*-0.75*	*-1.75*	*-1.00*
	1	-1.00	-1.50	-1.25	0.00	-0.50	-1.25	-0.50
	2	-1.00	-1.50	-1.25	0.75	1.00	-1.00	-0.25
	3	---	---	---	---	---	---	
	4	---	---	---	---	---	---	
	5	---	---	---	---	---	---	

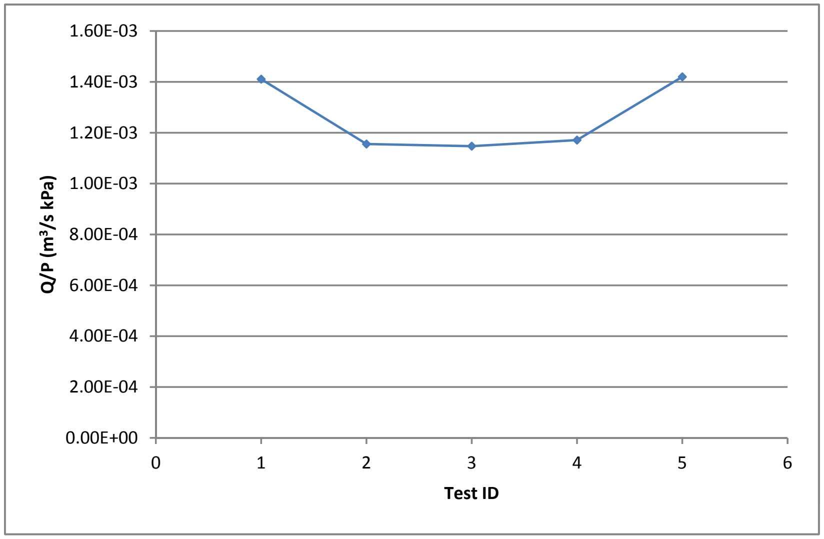
		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	***Initial Reading***	---	---	---	---	---	---
	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---

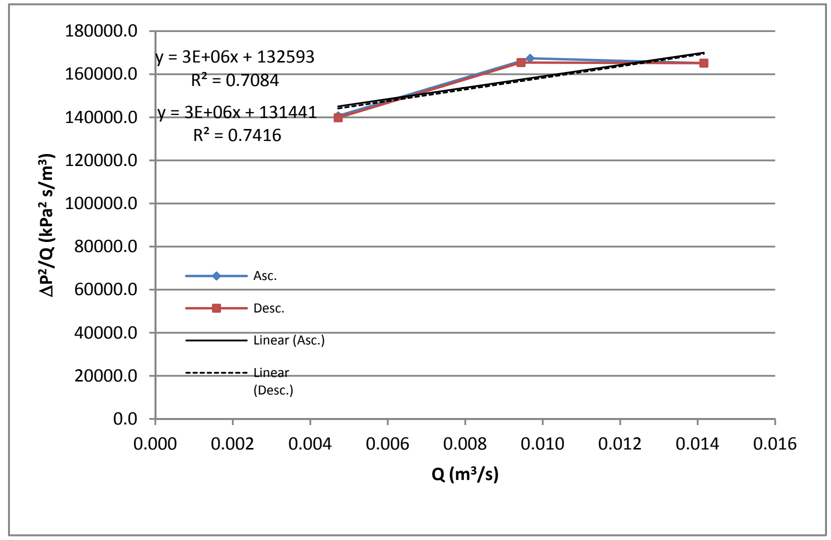
Corrected Data - Net Differential Manometer Measurement (mm H_2O)

	Measurement ID	Gas Port Number [Measurement Depth (m)]						
		1 [1.0]	**2 [3.0]**	**3 [5.0]**	**4 [7.0]**	**5 [11.0]**	**6 [13.0]**	**7 [15.0]**
CMT 145	1	0.00	0.50	0.50	0.50	2.00	1.75	0.75
	2	0.00	0.50	0.50	1.00	3.00	2.25	0.75
	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---

		1 [2.0]	**2 [4.0]**	**3 [6.0]**	**4 [8.0]**	**5 [12.0]**	**6 [14.0]**	**7 [16.0]**
CMT 146	1	0.00	0.00	-0.25	0.50	0.25	0.50	0.50
	2	0.00	0.00	-0.25	1.25	1.75	0.75	0.75
	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---

		1 [0.5]	**2 [1.0]**	**3 [2.0]**	**4 [3.0]**	**5 [5.0]**	**6 [6.0]**
CMT 147	1	---	---	---	---	---	---
	2	---	---	---	---	---	---
	3	---	---	---	---	---	---
	4	---	---	---	---	---	---
	5	---	---	---	---	---	---





Q/P (m^3/s kPa)
1.41E-03
1.16E-03
1.15E-03
1.17E-03
1.42E-03

APPENDIX B
COMPARISON OF SNOW (1969) AND BEAR ET AL. (1993) CUBIC LAW EQUATIONS

In the following appendix a comparison of the cubic equations of Snow (1969) [Equation 3.9] and Bear (1993) [Equation 3.12] will be presented. The prominent difference between the two equations is the method used to represent the fractures. Snow (1969) suggests that the fractures can be represented by the average fracture spacing, whereas, Bear (1993) uses porosity instead. It should be noted that any figure or equation references to material not contained within this appendix, refers to materials presented in the main body of the accompanying thesis.

Considering a cube of dimension L (Figure 3.20), with a set of parallel fractures, the porosity of the fracture pore space can be represented by:

$$\phi_f = \frac{\overline{V_f}}{\overline{V_t}} = \frac{\left(\sum_{i=1}^{m} b_i\right) L^2}{L^3} \qquad \text{[A2.1]}$$

where $\overline{V_f}$ and $\overline{V_t}$ are the fractured and total volumes, respectively, b_i is the effective aperture of the fractures in the ith direction (m), m is the total number of fractures in the ith direction, and L is the characteristic length perpendicular to the direction of flow (m). If the fractures are assumed to have a consistent aperture, the sum of the apertures can be replaced by the aperture multiplied by the total number of fractures, m, such that the porosity can be reduced to:

$$\phi_f = \frac{mb}{L} \qquad \text{[A2.2]}$$

The fracture spacing of Snow (1969) is the average distance between two fractures and is typically determined by dividing the study/measurement length by the number of intersecting fractures:

$$S = \frac{L}{m} \qquad \text{[A2.3]}$$

The fracture spacing inverted is equivalent to the ratio $\frac{m}{L}$ in Equation A2.2 and therefore Equation A2.2 can be reduced to:

$$\phi_f = \frac{b}{S} \qquad [A2.4]$$

Substitution of Equation A2.4 into 3.12 illustrates that Equation 3.12 and Equation 3.9 are identical, and that the use of the fracture spacing or porosity to represent the fractured pore space are equivalent.

APPENDIX C
SUMMARY OF BOREHOLE VIDEO LOG NOTES

Borehole **B Angular**
Date Recorded **Oct 13/2009**
Date Analyzed **Dec 14-16/2010**

Item #	Feature	Top of Feature (mbss)	Bottom of Feature (mbss)	Orientation	Relative Openness	Description	Video Snapshot	Corresonding Test
1	vertical fracture	0.38	---	S to N and W to E		several vertical fractures intersect over this length. All are very dark stained. 5 run from south to the north at spacing of about 3 cm. They run for about 10-20 cm in length. 1 runs directly down the borehole for about 25cm. They are all intersected by one long west to east running fracture. The W to E fracture intersects the borehole on the S side and two of the S to N intersect on the top of borehole and N side.	BA - 1	
2	horizontal fracture	---	0.45	full circumference	tight with holes	broken exterior and intersects vertical fractures		
3	vertical fracture	0.54	0.58	E to W	tight with holes	vertical fracture with broken exterior. Also some small micro fractures connecting to it.		
4	vertical fracture	0.53	0.60	E to W	tight with holes	closer to bottom of hole. Tight fracture with broken exterior.		
5	horizontal fracture	---	0.60	full circumference	tight with holes	broken exterior with small micro fractures scattered around this area.		
6	vertical fracture	0.69	---	E to W	tight	tight with dark staining. Seems to be short but is on the bottom of the borehole and covered in dust.		
7	vertical fracture	---	---	N to S	tight	tight fracture with dark staining could intersect horizontal fracture item 7		
8	vertical fracture	0.75	---	S to N	tight	tight fracture with dark staining intersecting the horizontal fracture item 7 and where it does there is a hole		
9	vertical fracture			E to W	partially open	large band of dark staining intersects two other vertical fractures and three horizontal fractures	BA - 2	
10	horizontal fracture	---	0.82	full circumference	partially open	large area of broken material. Covered in dark stained broken blocky crystals. Intersected by item 9.		
11	vertical fracture	0.84	---	C to SE	partially open	large band of dark staining. Partially open with holes where it meets item 15. intersects item 9 and 15		
12	vertical fracture	0.84	---	C to NE	partially open	large band of dark staining. Intersects item 9 and 15 and large holes where it intersects item 15		
13	horizontal fracture		0.88	full circumference	tight fracture	tight fracture with slightly visible dark staining. Intersected by item 9, 11 and 12		220909-B-Ang-1 Begins
14	horizontal fracture		0.89	full circumference	tight fracture	tight fracture with no visible dark staining. Bottom boundary to yellow blocky crystals with tight matrix material below. Moisture evident on the walls.		
15	horizontal fracture		0.93	full circumference	vary open	this fracture is extremely open with large block on N side of borehole which looks to fall off. On the south side it looks as if a chunk of the fracture has already fallen off leaving a large hole with a great deal of dark staining and staining on the borehole wall where material may have come out of the hole. columnar crystals are present here in the hole. It is intersected by item 9 as it runs down the hole. It is also intersected by item 11 and 12 on the upper south and north side respectively. on the top of the borehole it is extremely wide open with black staining along its face	BA - 4 & BA - 5	
16	vertical fracture	0.93	1.34	S to N	tight with holes	comes out of dark stained area on the north side of item 15 and runs down the south wall where it intersects a vert fracture item 17		
17	vertical fracture	0.95	1.03	E to W	tight with holes	dark stained fracture starting at bottom of item 16 runs down the borehole on south side to item 21. Also other dark stained vert fractures coming off this fracture. smaller vertical fractures run in both directions from this fracture		
18	vertical fracture	0.93	1.03	E to W	tight with holes	large dark stained area. Fracture runs e to w along north central side of borehole wall towards item 21. Smaller vertical fractures run in both directions from this fracture		
19	vertical fracture	0.94	1.08	N to S	tight	tight fracture with dark staining runs N to S towards bottom of borehole from where item 19 meets item 21 on the north side of the borehole. Connects with item 20 as they may be part of the same vertical fracture	BA - 6	
20	vertical fracture	0.94	1.15	N to S	tight	tight fracture with dark staining runs N to S towards bottom of borehole from where item 18 meets item 21 on the north side of the borehole	BA - 6	
21	horizontal fracture		1.03	full circumference	partially open	very thick dark staining with extremely thick staining where it meets item 17 and 18		
22	vertical fracture	1.03	1.24	E to W	partially open	thick dark stained fracture. Comes out of item 21 and heads down the top of the borehole.	BA - 7	
23	vertical fracture	1.03	1.24	E to W	partially open	dark stained fracture comes out of item 20 and heads E to W down the bottom of the borehole on southern side. Looks to have come from back up the borehole as it heads W up the borehole		
24	horizontal fracture		1.07	full circumference	partially open	the portion of the fracture on the top of the hole is dark stained with item 22 passing through.		
25	horizontal fracture		1.12	full circumference	open	portion of fracture on top of borehole and sides is open with large dark stained band. Where it meets the bottom of the borehole there are large holes with evident crystals and dark staining. Item 22 stops here and there is large dark spot where it does	BA - 8	

Item #	Feature	Top of Feature (mbss)	Bottom of Feature (mbss)	Orientation	Relative Openness	Description	Video Snapshot	Corresonding Test
26	vertical fracture	1.12	1.34	N to S	tight	tight fracture with dark staining. Runs from center of borehole to bottom N to S from item 25		
27	horizontal fracture	---	1.18	full circumference	partially open	partially open fracture with vertical fractures running down the sides. Change in crystal structure.		
28	vertical fracture	1.18	1.39	N to S	tight	tight fracture on the south side with dark staining runs from item 30 down to the bottom of the borehole. In some places it looks to be just broken crystals.		
29	vertical fracture	1.18	1.39	N to S	tight with holes	tight fracture on the north side. Runs N to S down from item 30. where it intersects item 30 there are large open holes on the horizontal fracture.		
30	horizontal fracture	---	1.23	full circumference	open	fracture is open along the top of the borehole with large open holes where vertical fractures intersect. There seems to be some areas where dust may be in fracture and small debris. Small micro fractures also run down from this fracture.		
31	horizontal fracture	---	1.31	full circumference	tight	crystal structure change with dark staining along fracture. micro fractures coming from fractures		
32	horizontal fracture	---	1.34	full circumference		crystal structure change with dark staining along fracture. micro fractures coming from fractures		
33	vertical fracture	1.31	1.34	N to S	tight	tight small fracture connecting item 31 and 32 on the south side of the borehole		
34	vertical fracture	1.31	1.34	N to S	tight	tight small fracture connecting item 31 and 32 on the south side of the borehole		
35	horizontal fracture	---	1.37	full circumference	tight with holes	on the top of the borehole the fracture looks like a crystal structure change. On the bottom of the borehole it is broken with a fair number of holes		
36	horizontal fracture	---	1.39	full circumference	tight	tight fracture along the top of the borehole. Vertical fractures running from item 35 to this fracture		
37	vertical fracture	1.39	1.60	E to W	tight	tight fracture with black staining runs through the fractures in this area.		
38	vertical fracture	1.39	1.60	N to S	tight	tight fracture with black staining comes out of item 37 on the top of the borehole seems to almost run parallel for a couple of cm and then connects back.		
39	horizontal fracture	---	1.44	full circumference	tight	tight fracture at crystal change with blocky yellow crystals above it.		
40	vertical fracture	1.44	1.58	N to S	tight	tight fracture with black staining runs N to S along the south side of the hole and stops at small black dots		
41	horizontal fracture	---	1.51	full circumference	tight with small holes	seems to be a crystal structure change. On the top and sides there are some small holes on the face. Can see some yellow blocky crystals but tighter material below it		
42	vertical fracture	1.51	1.58	E to W	tight	tight fracture runs from item 41 down to the next horizontal fracture along the top of the borehole item 44		
43	vertical fracture	1.58	1.80	N to S	tight	two tight fractures along the south wall run from item 44 to the bottom of the borehole. Slight dark staining.		
44	horizontal fracture	---	1.58	full circumference	tight	tight fracture with indentation along fracture face with black staining slightly visible all along fracture.		
45	horizontal fracture	---	1.68	full circumference	tight with holes	fracture is black stained all along borehole. On the north side where it meets the bottom of the borehole there are some holes with columnar crystals inside. Along the borehole there are small holes and little black stained micro fractures. Above this fracture the material is yellow blocky crystals	BA - 9	
46	horizontal fracture	---	1.70	full circumference	tight	tight fracture with small holes and less visible black staining.		
47	horizontal fracture	---	1.73	full circumference	tight	tight fracture at a crystal change small vertical fracture running for a couple of centimeters W to E along top of the borehole		
48	horizontal fracture	---	1.77	full circumference	tight	tight fracture with slight black staining.		
49	horizontal fracture	---	1.85	full circumference	tight	tight fracture with slight black staining		220909-B-Ang-1 Ends
50	horizontal fracture	---	1.94	full circumference	tight with small holes	tight fractures with black staining and vertical fracture running from the sides of the fractures to the bottom of the borehole. Below this fracture there is the blocky yellow crystal structure and broken material.		220909-B-Ang-2 Begins
51	vertical fracture	1.87	2.07	N to S	tight	tight N to S fracture on the north side of the borehole that connects item 50 with the fracture below it and also continues to run to the bottom of the borehole		
52	vertical fracture	1.87	2.08	N to S	tight	tight N to S fracture on the south side of the borehole that connects item 50 with the fracture below it and also continues to run to the bottom of the borehole. This fracture has a larger black stained area than item 51		
53	vertical fracture	1.97	2.18	N to S	tight	the first cm or two are black stained directly below item 50 and then the dark staining disappears and the fracture continues to run down the south side of the borehole.		
54	horizontal fracture	---	2.07	full circumference	tight with holes	fracture is tight through a zone of crystal change. In some areas the fracture is open as material has broken and fallen away.		
55	horizontal fracture	---	2.13	full circumference	tight with open holes	this is at another crystal change with blocky yellow crystals above and tighter material below. There is small holes on the upper south side as a vertical fracture intersects this fracture.	BA - 10	
56	vertical fracture	2.07	2.13	E to W	partially open	this fracture is tight in most places with dark staining and large holes where it intersects item 54. The fracture spider webs and just above item 54 and a N to S fracture runs to the top of the borehole		
57	horizontal fracture	---	2.21	full circumference	tight with holes	fracture is tight with slightly blocky yellow matrix above the fracture and dull material below it. There are small holes and broken material where the fracture intersects the bottom of the borehole		
58	horizontal fracture	---	2.28	full circumference	tight	tight fracture that is a change in crystal structure		
59	horizontal fracture	---	2.36	full circumference	tight	tight fracture with slightly visible dark staining and small open holes along the top of the boreholes. At the bottom of the borehole the fracture is open with crystals visible in the fracture		
60	horizontal fracture	---	2.43	full circumference	tight	tight fracture with a evident crystal change. Dark yellow material above and tight material below. Dark staining on the fracture with small holes on the top		

Item #	Feature	Top of Feature (mbss)	Bottom of Feature (mbss)	Orientation	Relative Openness	Description	Video Snapshot	Corresonding Test
61	vertical fracture	2.36	2.43	N to S	tight	tight fracture with slightly broken exterior runs along the south side of the borehole and connects item 59 and 60		
62	horizontal fracture	---	2.57	full circumference	tight with holes	tight fracture with dark staining and indentation along top of borehole where material was broken away. In broken away area there is water and vertical fracture comes out of this area heading down the borehole. The water seems to ooze down the side of the borehole. crystal change with tight material above and blocky crystals below in broken area. Open dark holes on top north side and on west side with dark staining on the wall below these holes. micro fracture connecting this to other fracture above and below.		
63	vertical fracture	2.57	2.85	C to NE	tight	tight fracture with dark staining starts at item 62 and heads along top of borehole towards next horizontal fracture and carries through.		
64	horizontal fracture	---	2.56	full circumference	tight	tight with dark staining along the fracture with item 643 passing through.		
65	horizontal fracture	---	2.62	full circumference	tight	tight fracture with broken material or indentation along the fracture. Item 63 seems to stop here on the north side of the borehole. Looks slightly broken below this fracture so may continue on.		
66	horizontal fracture	---	2.64	full circumference	tight	tight fracture barely noticeable until directly below it. Just above item 67		
67	horizontal fracture	---	2.65	full circumference	tight with open holes	tight fracture at a slight crystal change with open holes all along the fracture. Breakage at holes may be due to close proximity to tight fractures above and below it. Micro fractures connect this to fracture directly above and below.		
68	horizontal fracture	---	2.67	full circumference	tight	tight fracture separating crystal change. Broken material above with tight material below.		
69	horizontal fracture	---	2.74	full circumference	tight	tight fracture with some indentation along fracture		
70	horizontal fracture	---	2.76	full circumference	tight	tight fracture with broken material along sides on both the north and south side of the borehole		
71	horizontal fracture	---	2.79	full circumference	tight	tight fracture with indentation along borehole		
72	vertical fracture	2.85	3.06	N to S	tight	tight fracture running from item 71 down to the bottom of the borehole. Broken Exterior along the fracture. It intersects to the fracture below. Item 73 . There is water on the face of this fracture. Might be water coming from the fractures above that were noted to have water running down the side of the borehole.	BA - 11	
73	horizontal fracture	---	2.85	full circumference	tight	tight fracture with crystal change. Broken material below this fracture		220909-B-Ang-2 Ends
74	horizontal fracture	---	2.88	full circumference	tight with holes	the top portion of the fracture is highly indented where material may have broken away. On the bottom of the borehole, on both sides, there are large holed areas where the fracture meets the bottom. Seems to be water on the broken part of the fracture face on the top of the borehole		220909-B-Ang-3 Begins
75	vertical fracture	2.88	3.09	N to S	tight	fracture has broken exterior and run down the south side of the borehole from item 74.		
76	horizontal fracture	---	2.93	full circumference	tight	tight fracture as boundary to broken material above it. Tighter matrix material below. Fracture is visibly dark stained.		
77	horizontal fracture	---	2.96	full circumference	tight	tight fracture as another boundary to the crystals below item 76 and material is even tighter below this fracture		
78	horizontal fracture	---	2.98	full circumference	tight	tight fracture with yellow blocky crystal below it. Slightly visible black staining		
79	horizontal fracture	---	3.17	full circumference	tight	tight fracture with no visible staining. Boundary of blocky yellow crystals above it		
80	vertical fracture			N to S	tight	tight fracture with broken face coming from item 79 to item 85		
81	vertical fracture	3.01	3.17	N to S	partially open	partially open fracture running N to S. Runs from item 79 down the South side of the borehole and is open along the bottom of the borehole with evident dark staining and seems to run to the other side and up the north side of the borehole to connect on the other side to item 79.		
82	horizontal fracture	---	3.17	full circumference	tight	tight fracture		
83	horizontal fracture	---	3.19	full circumference	tight	tight fracture with slightly visible dark staining		
84	horizontal fracture	---	3.20	full circumference	tight	tight fracture with broken areas along the top south side of the fracture where vertical fracture from above intersects.		

Item #	Feature	Top of Feature (mbss)	Bottom of Feature (mbss)	Orientation	Relative Openness	Description	Video Snapshot	Corresonding Test
85	horizontal fracture	---	3.22	full circumference	tight	tight fracture with slightly visible dark staining on the south side. Harder to see on the south side at the top.		
86	horizontal fracture	---	3.23	full circumference	tight with holes	tight fracture with evident dark staining and slits on the north side of the borehole. Broken material forms a ledge underneath it. Where it intersects the bottom of the borehole the material is broken with holes appearing.	BA - 12	
87	vertical fracture	3.17	3.23	N to S	tight	tight fracture running from item 82 to item 86 and also spider webs out in E to W direction up the borehole.		
88	horizontal fracture	---	3.25	full circumference	tight	tight fracture with visible dark staining. Just below item 86 with maybe not even a cm distance between. May be reason for broken material. Small micro fractures connect the two.		
89	horizontal fracture	---	3.28	full circumference	tight	tight fracture with blocky yellow crystals above it.		
90	horizontal fracture	---	3.32	full circumference	tight	tight fracture just below item 89 with visible dark staining.		
91	horizontal fracture	---	3.42	full circumference	tight with holes	tight fracture with indentation along borehole. Where it intersects the bottom of the borehole there is broken material, holes, crystals and dark staining in holes		
92	horizontal fracture	---	3.46	full circumference	tight	tight fracture in tight material with broken material below the fracture at the top and north side of the borehole.		
93	horizontal fracture	---	3.62	full circumference	tight	this fracture seems to be the bottom boundary of the broken zone.		
94	horizontal fracture	---	3.65	full circumference	open	fracture is through a broken zone with crystals evident on the holes along the north side with moisture on the fracture face		
95	horizontal fracture	---	3.71	full circumference	tight	tight fracture just below broken area. Almost a stepped appearance in this area as there are about four fractures in a row with a bunch of broken material below each fracture.	BA - 13	
96	horizontal fracture	---	3.72	full circumference	partially open	this fracture is at an area of broken material and there are small holes along the top of the borehole with dark staining along the sides of the borehole. There is water on the fracture. On the north side there are small holes where item 98 intersects and runs towards the bottom of the borehole.	BA - 14	
97	horizontal fracture	---	3.73	full circumference	tight with holes	there are small holes on the south where item 98 intersects this fracture. The surrounding material becomes tighter at this location with exception of north side where it is all broken.		
98	vertical fracture	3.71	3.92	N to S	tight	tight fracture with broken exterior. It runs through almost all of the horizontal fractures in this area. Starting at item 95 on the north side		
99	vertical fracture	3.75	4.00	N to S	tight	tight fracture on the south side runs nearly the same distance as item 98 but is a little farther down the holes.		
100	horizontal fracture	---	3.85	full circumference	tight	tight fracture as boundary of yellow darker crystal zone. There is water in the yellow crystal zone in the form of water droplets.		220909-B-Ang-3 Ends
101	vertical fracture	3.83	4.04	SW to EC	tight	This fracture seems to enter the top of the borehole just above item 100 and passes through item 100 and then heads E to W and then curves to center of the borehole where it stops.		220909-B-Ang-4 Begins
102	horizontal fracture	---	3.94	full circumference	tight	tight with dark staining. Above it is tighter matrix and below it is again dark blocky yellow crystals.		
103	vertical fracture	3.94	4.15	N to S	tight	tight fracture with broken exterior on the north side of the borehole. Runs through item 102 and to the bottom of the borehole on the north side		
104	horizontal fracture	---	4.00	full circumference	tight	tight fracture with crystal change. Blocky yellow crystals above it and tighter material below it.		
105	horizontal fracture	---	4.07	full circumference	tight	tight fracture with even tighter material below it then in the region from 104 to 105. visible dark staining.		
106	vertical fracture	4.07	4.28	N to S	partially open	dark stained fracture on the south Side runs from item 105 to bottom of borehole and maybe intersects item 104. Quite dark staining where it meets 105. Also seems to go up towards the top of the hole as well.		
107	vertical fracture	4.00	4.07	E to W	tight	runs from item 104 towards item 105 along the top of the borehole. Broken exterior with slightly visible broken exterior.		
108	horizontal fracture	---	4.13	full circumference	tight	tight fracture. Only evident because of crystal structure change from dark to light yellow. Tight material on top and bottom.		
109	horizontal fracture	---	4.19	full circumference	tight	tight fracture separating crystal change with dark yellow crystals above and tighter matrix material below.		
110	vertical fracture	4.13	4.26	E to W	tight	tight fracture runs along the top of the borehole from item 108 to 109 and runs through to item 111		
111	horizontal fracture	---	4.26	full circumference	tight	dark stained fracture with dark crystals below it with moisture on the dark crystals		
112	horizontal fracture	---	4.35	full circumference	tight	tight fracture separating crystal change.		
113	vertical fracture	4.31	4.40	N to S	tight	tight dark stained fracture runs from 112 to 114		
114	horizontal fracture	---	4.40	full circumference	partially open	partially open fracture tight in most places with some holes on the north side. Dark crystals on the fracture face with darker yellow crystals above it.		
115	vertical fracture	4.44	4.65	N to S	tight	runs from item 114 to bottom of borehole quite tight and looks to be water on the crack.		
116	horizontal fracture	---	4.44		tight	tight fracture with change in crystals		
117	horizontal fracture	---	4.48	full circumference	tight	tight dark staining all around fracture with little water droplets on the fracture face		

Item #	Feature	Top of Feature (mbss)	Bottom of Feature (mbss)	Orientation	Relative Openness	Description	Video Snapshot	Corresonding Test
118	horizontal fracture	---	4.52	full circumference	tight with holes	tight fracture with a lot of broken material. On the south side a vertical fracture runs down from this location and where it intersects there is a large hole.		
119	vertical fracture	4.49	4.70	N to S	tight with holes	tight dark stained fracture runs down from item 118 and comes out of hole on north side of borehole.		
120	horizontal fracture	---	4.55	full circumference	tight	tight fracture indicated by broken material and slightly visible dark staining on the sidewalls. Moisture again throughout this zone and continuing on down the borehole.		
121	horizontal fracture	---	4.62	full circumference	tight	tight fracture with dark staining.		
122	vertical fracture	4.62	-0.40	N to S	tight	tight fracture runs from item 121 to item 126		
123	vertical fracture	4.62	4.84	E to W	partially open	partially open fracture runs from item 121 down the top north side of the borehole.		
124	vertical fracture	4.62	4.76	E to W	tight	tight fracture runs down the top center of the borehole from item 121 to 126		
125	vertical fracture	4.62	4.76	E to W	partially open	partially open fracture running along the top south side of the borehole from item 121 to item 126		
126	horizontal fracture	---	4.76	full circumference	open	partially open fracture with large holes throughout the fracture. There are large holes where the vertical fractures on the top of the borehole run down the top and intersect	BA - 16	
127	vertical fracture	4.84	5.05	N to S	partially open	item 123 intersects 126 and then runs N to S down the side of the borehole.		
128	horizontal fracture	---	4.78	full circumference	tight	tight fracture at crystal change with broken off material along the fracture face. Blocky yellow crystals below this fracture with water all along the crystals on the top of the borehole.	BA - 17	220909-B-Ang-4 Ends
129	horizontal fracture	---	4.89	full circumference	tight	tight fracture and is the bottom boundary to the block yellow crystals.		220909-B-Ang-5 Begins
130	vertical fracture	4.87	5.08	N to S	tight	tight dark stained fracture running down the side of the borehole from item 129		
131	vertical fracture	4.89	5.12	S	tight	tight fracture with wide broken exterior on the south side and water starting to come from this location. Intersecting from item 129 and running down to item 134		
132	vertical fracture	4.94	5.12	N to S	tight	tight fracture with wide broken exterior on the north side. Water below it. May be part of item 131 Intersecting from item 129 and running down to item 134		
133	vertical fracture	5.08	5.19	E to W	tight	tight fracture running down the top of the borehole with broken exterior.		
134	horizontal fracture	---	5.12	full circumference	tight with holes	holes on the top of the borehole along the face with a ledge like structure		
135	horizontal fracture	---	5.19	full circumference	tight with holes	visible dark staining on the fracture with a small hole on the top north side and a hole on the northern wall.		
136	horizontal fracture	---	5.28	full circumference	tight	tight fracture on the top south side with small crystals present in the hole. Indentation along the fracture and a small ledge at the fracture face. On the north top side small slit where fracture running E to W on top (item 137) starts		
137	vertical fracture	5.28	5.35	E to W	tight with holes	tight fracture with small holes along its length. There are water droplets along the fracture with very little of the water droplets being farther than a cm away from the fracture. There is numerous holes along the fracture. runs from item 136 to item 139 along the top of the borehole	BA - 18	
138	vertical fracture	5.31	5.35	N to S	tight	tight fracture with broken exterior on North side of the borehole running from the top of the borehole into item 139.		
139	horizontal fracture	---	5.35	full circumference	tight	tight fracture with dark staining and small holes. Marking crystal structure change. Water in this area all around the fracture. Mainly where item 137 meets.		
140	horizontal fracture	---	5.40	full circumference	tight with holes	tight fracture with slightly visible dark staining and a ledge like appearance. Small holes on the top of the borehole with a flat ledge like broken section on the south side. Water underneath the flat ledge.		
141	horizontal fracture	---	5.44	full circumference	tight	tight fracture at crystal structure change with ledge like shape. Dark yellow crystals above it with lighter crystal below it but doesn't seem to be tight matrix		
142	horizontal fracture	---	5.49	full circumference	tight	tight fracture with ledge shape and crystal structure change. This fracture is close to 141 and material below is tighter. Slightly visible dark staining.		
143	horizontal fracture	---	5.49	full circumference	tight	tight fracture at crystal structure change. Visible dark staining along fracture. Numerous vertical fractures intersect it along the south side. Above is bright yellow crystals. Tighter material below.		
144	vertical fracture	5.47	5.69	N to S	partially open	partially open fracture with broken exterior. Runs from item 143 to the bottom of the borehole. On the south side of the borehole.		
145	vertical fracture	5.40	5.44	E to W	tight	tight fracture with broken exterior on the top of the borehole. Runs from item 140 to 141.		
146	vertical fracture	5.47	5.69	C to SW	tight	tight with broken exterior. Seems to come from where item 144 meets bottom of the borehole and then runs inclined to the top of the borehole		
147	horizontal fracture	---	5.47	full circumference	tight	tight fracture at crystal structure change. Dark yellow blocky crystals above it with bright yellow crystals below.		
148	vertical fracture	5.58	5.79	N to S	patially open	fracture on north side with broken exterior. Fracture runs from the bottom of the borehole where you can see some small slits, to the top of the borehole through item 149 and then up to the top of the borehole where it intersects E to W item 150		
149	horizontal fracture	---	5.61	full circumference	tight	tight fracture with visible dark staining. Above this fracture there are large blocky yellow crystals with tighter material below. Intersected by vertical fractures on the north side.		

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150	vertical fracture	5.47	5.61	E to W	tight	tight fracture running along the top of the borehole connects item 147 and 149. Intersected by N to S item 148		
151	horizontal fracture	---	5.73	full circumference	tight	tight fracture with ledge like appearance. Small holes along fracture and moisture all around this area. On the bottom of the borehole there is some broken away material with some evident crystals		220909-B-Ang-5 Ends
152	horizontal fracture	---	5.83	full circumference	tight	tight fracture at crystal change with blocky yellow material above the fracture and tighter material below.		220909-B-Ang-6 Begins
153	horizontal fracture	---	5.90	full circumference	tight	tight fracture with broken areas along the borehole		
154	vertical fracture	5.90	6.11	N to S	tight	tight fracture with broken exterior running on the north side from 153 to bottom of the borehole		
155	horizontal fracture	---	5.99	full circumference	tight with holes	tight fracture with ledge shaped appearance. On the north side of the borehole there is a large broken away area where a vertical fracture that runs down the borehole. On the south side there is a large hole just below the fracture.		
156	vertical fracture	5.99	6.20	N to S	tight with holes	tight fracture on the south side of the borehole. The fracture runs down from item 155 to the bottom of the borehole.		
157	vertical fracture	6.07	6.29	E to W	partially open	tight fracture runs from item 155 to the next horizontal fracture along the top north side of the borehole. It runs E to W until it reaches item 158 where it seems to run almost N to S to item 159. just below item 158 there are small opening in the fracture. just below the 159 the fracture seems to run N to S to the bottom of the borehole.		
158	horizontal fracture	---	6.07	full circumference	tight with holes	seems to be part of crystal structure change with blocky yellow crystals at the fracture with areas broken away. On the north side where item 156 intersects there are large broken material and small holes.		
159	horizontal fracture	---	6.10	full circumference	tight	tight fracture signifies again another crystal structure change. With tighter material below it.		
160	horizontal fracture	---	6.14	full circumference	tight	tight fracture. Seems to be a slight crystal change and item 157 seems to run through this fracture on the north side.	BA - 19	
161	horizontal fracture	---	6.19	full circumference	partially open	large broken area at the top of the borehole. Water along fracture, above and below it as well. Tighter on the south and north sides of the borehole.		
162	vertical fracture	6.19	6.25	N to S	tight	tight fracture running from item 161 to 164.		
164	horizontal fracture	---	6.25	full circumference	tight	tight fracture distinguishable by crystal change with small broken material along fracture at top of borehole		
165	horizontal fracture	---	6.31	full circumference	tight	tight fracture at crystal structure change from blocky yellow material to tighter material below		
166	horizontal fracture	---	6.40	full circumference	partially open	partially open fracture with large slits along the borehole. Ledge appearance. Vertical fracture running down from fracture on the north side where we see some of those slits.		
167	vertical fracture	6.46	6.60	N to S	tight	tight fracture with broken exterior on the North side running down from item 166 to the bottom of the borehole.		
168	horizontal fracture	---	6.51	full circumference	tight	tight fracture at crystal structure change with yellow crystals above and tighter material below.		
169	horizontal fracture	---	6.53	full circumference	tight	tight fracture with broken spots along the fracture but not continuous		
179	horizontal fracture	---	6.57	full circumference	tight	tight fracture with broken area below it between itself and the horizontal fracture below it.		
180	horizontal fracture	---	6.59	full circumference	tight with holes	tight fracture with large holes on the north side. As it meets the bottom of the borehole there is some areas broken away leaving holes.		
181	horizontal fracture	---	6.61	full circumference	tight with holes	it is hard to make out the fracture on the top of the borehole but on the sides of the borehole there is some holes that line up on the north and south side. Part of a large broken area on both the north and south sides.		
182	vertical fracture	6.61	6.82	N to S	tight with holes	tight fracture with holes where it meets item 180. It runs on the south side of the borehole from item 180 to the top of the borehole.		
183	horizontal fracture	---	6.73	full circumference	tight with holes	tight fracture with ledge appearance and small holes along the fracture. Fracture is tighter on the direct south and north side but towards the bottom of the borehole there are large broken areas. Water all along it.		220909-B-Ang-6 Ends
184	horizontal fracture	---	6.78	full circumference	tight	tight fracture with small broken ledge along the top of the borehole.		220909-B-Ang-7 Begins
185	vertical fracture	6.78	6.83	E to W	tight	tight fracture runs from item 184 to 186 along the top of the borehole.		
186	horizontal fracture	---	6.83	full circumference	tight with holes	tight fracture with holes where it vertical fracture item 188 begins. Broken ledge at vert fracture location.		
187	vertical fracture	6.80	7.01	N to S	tight	tight fracture on the north side run down from item 186 towards the bottom of the borehole.		
188	vertical fracture	6.83	6.96	N to S	partially open	fracture comes out of holes on item 186 on the top north side. As it runs down towards the bottom of the borehole there are holes along it. Runs down to the next three horizontal fractures items 189, 190 and 191 where it stops at 191.		
189	horizontal fracture	---	6.85	full circumference	tight	tight fracture at crystal change with dark yellow crystals above and slightly lighter material below.		
190	horizontal fracture	---	6.89	full circumference	tight	tight fracture with small indentations along fracture face and holes on the north side where vertical fracture intersects it. Might not be open holes but large indentations.		
191	horizontal fracture	---	6.96	full circumference	tight	tight fracture with ledge like appearance. Water on the on the fracture on the south side. Broken holes on the south.		
192	horizontal fracture	---	7.03	full circumference	tight with holes	ledge like appearance with holes along the south and north side. Vert fracture coming out on south side		
193	vertical fracture	7.01	7.22	N to S	partially open	fracture runs from item 192 on the south side towards the bottom of the borehole. Passes through broken area and there is open holes as it passes through this area.		
194	vertical fracture	7.03	7.10	N to S	tight	tight fracture with broken exterior on the opposite side of the borehole of 193. Also runs down from 192 to item 195.		

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195	horizontal fracture	---	7.10	full circumference	open	this fracture is open with a evident gap or wide aperture all along the fracture. Very broken material where vert fractures 193 and 194 pass through it. At the top of the borehole you can see crystals inside the open portion. On the south side there is small vertical fractures that runs from it and small holes where it comes around to meet the bottom of the borehole. On the north side there is a large open slit.	BA - 20, BA - 21, BA - 22, BA - 23, BA - 24, & BA - 25	
196	vertical fracture	7.10	7.13	N to S	tight	tight fracture on the north side runs from item 195 to item 197		
197	horizontal fracture	---	7.13	full circumference	tight with open holes	tight fracture seems to almost merge with item 195 but can see some independent open slits on the south side.		
198	horizontal fracture	---	7.18	full circumference	tight	tight fracture with some holes along the south and north side where it meets the bottom of the borehole. On the top of the borehole you can see a crystal change from blocky yellow crystals to tighter material.		
199	vertical fracture	7.18	7.29	N to S	tight	tight fracture with broken exterior runs from item 198 to 200 on the north side		
200	horizontal fracture	---	7.29	full circumference	tight	tight fracture with broken material along face and blocky yellow crystals along the fracture. On the south side of the borehole and along the top of the borehole there is small openings with visible crystals.		
201	vertical fracture	7.29	7.50	NW to C	tight	tight fracture runs from item 200 upwards and then along the top of the borehole and then runs E to W from the top of the borehole and runs into item 200 at the center of the borehole.		
202	horizontal fracture	---	7.42	full circumference	tight	tight fracture is at crystal change from blocky yellow crystals around item 200 to tighter material below.		
203	horizontal fracture	---	7.47	full circumference	tight	tight fracture is at crystal change from tighter yellow crystals to tighter material		
204	horizontal fracture	---	7.49	full circumference	partially open	ledge like appearance with visible crystals along the fracture at the top of the borehole and water directly on the fracture.	BA - 26	
205	horizontal fracture	---	7.55	full circumference	tight	tight fracture at crystal change.		
206	vertical fracture	7.49	7.63	N to S	tight	tight fracture with broken exterior seems to run E to W from item 204 to 205 and then runs down the north side of the borehole to item 207.		
207	horizontal fracture	---	7.63	full circumference	tight	tight fracture at crystal structure change with small holes along the fracture face. Slightly visible staining.		
208	horizontal fracture	---	7.70	full circumference	tight	tight fracture evident by broken and indented material with slight crystal change		220909-B-Ang-7 Ends
208	horizontal fracture	---	7.74	full circumference	tight	tight fracture with blocky yellow crystals along its face.		220909-B-Ang-8 Begins
209	horizontal fracture	---	7.77	full circumference	tight with open holes	tight fracture along the top of the borehole with holes on the north side just below item 208. on the south side you can also see some small holes with crystals evident.		
210	horizontal fracture	---	7.81	full circumference	tight	tight fracture at crystal change from yellow crystals to tighter material		
211	horizontal fracture	---	7.84	full circumference	tight with holes	on the south top side of the borehole there is some broken material. Hard to see the fracture on top north but on the sides of the borehole there is holes		
212	vertical fracture	7.84	8.05	N to S	partially open	fracture is slight dark stained with holes where it meets item 211 and just below it. Seems to run on the south side of the borehole from item 211 to the bottom of the borehole.		
213	horizontal fracture	---	7.91	full circumference	tight	tight fracture at crystal change		
214	vertical fracture	7.91	8.09	E to W	open	fracture with open slit runs from item 213 to 215 along the south top of the borehole. As it meets item 215 it seems to run down N to S to meet the next couple of horizontal fractures.		
215	horizontal fracture	---	7.98	full circumference	open	open fracture with ledge like appearance. Very open holes on the top of the borehole. Where it intersects the vertical fractures it has large holes. Water droplets on fracture face on the top of the borehole. Open holes where it intersects the bottom of the borehole.		
216	vertical fracture	7.95	8.09	N to S	tight	tight fracture runs from item 215 on the north side of the borehole and continues down through the next couple of horizontal fractures		
217	horizontal fracture	---	8.02	full circumference	tight with open holes	tight fracture is boundary of yellow blocky crystals around item 215 with vertical fracture coming down on the north side towards the bottom of the borehole. Up close you can see somewhat ledge like appearance with slits along the south side of the fracture.		
218	vertical fracture	7.98	8.20	N to S	tight	tight with broken exterior. Runs down the North side of the borehole from item 217.		
219	horizontal fracture	---	8.05	full circumference	tight	tight fracture with small open holes and crystals in broken area on the south side. Broken material on the top of the borehole.		
220	horizontal fracture	---	8.09	full circumference	tight	tight fracture with slight indentation along the top of the borehole.		
221	vertical fracture	8.05	8.09	E to W	tight with holes	tight fracture with small holes runs from what seems to be item 217 through the horizontal fractures stopping at 220.		

Item #	Feature	Top of Feature (mbss)	Bottom of Feature (mbss)	Orientation	Relative Openness	Description	Video Snapshot	Corresonding Test
222	vertical fracture	8.23	8.44	N to S	tight	tight fracture with broken exterior runs down the north side of the borehole from item 223.		
223	horizontal fracture	---	8.23	full circumference	tight with holes	tight fracture at crystal structure change with hole on south side where vertical fracture meets item 222		
224	vertical fracture	8.14	8.32	E to W	partially open fracture	partially open fracture runs along the south bottom of the borehole down the borehole.		
225	horizontal fracture	---	8.29	full circumference	tight will large holes	tight fracture with ledge like appearance along the top. Closed at top with large holes on the north side where item 222 and 226 run down the north side of the borehole.		
226	vertical fracture	8.26	8.47	N to S	tight with large holes	this fracture runs out of a large hole on the north side of the borehole from item 225.		
227	vertical fracture	8.29	8.54	E to W	partially open	tight fracture with broken exterior runs down from item 225 to item 228. Where it intersects item 228 there are open slits. Seems to carry on down the top of the borehole and begins to run towards the north side.		
228	horizontal fracture	---	8.37	full circumference	partially open	large hole on the north side of the borehole and partially open where item 227 intersects it. Ledge like appearance with indentation along the fracture.		
229	horizontal fracture	---	8.41	full circumference	tight with holes	ledge like appearance with blocky crystals along fracture face. Small holes along fracture at the top. Right below item 228 and intersected by fracture 227 on the top north of the borehole. Visible staining.		
230	horizontal fracture	---	8.37	full circumference	tight	crystal change with bright yellow material above and tighter material below.		
231	vertical fracture	8.37	8.51	E to W	tight	tight fracture with visible dark staining runs along the top north side of the borehole and intersects item 232		
232	horizontal fracture	---	8.51	full circumference		tight fracture with visible dark staining. Intersected by 231. On the bottom of the borehole you can see some open holes. There is a great deal	BA - 27	
233	horizontal fracture	---	8.62	full circumference	tight with holes	tight fracture with open holes and large broken material below on the north side.		
234	horizontal fracture	---	8.69	full circumference	tight	crystal change with darker yellow material above the fracture and dull tighter material below.		220909-B-Ang-8 Ends
235	horizontal fracture	---	8.73	full circumference	tight	crystal change		240909-B-Ang-1 Begins
236	horizontal fracture	---	8.75	full circumference	tight	crystal change lots of water present around fracture		
237	horizontal fracture	---	8.78	full circumference	tight with holes	holes on north side with small ledge on top of borehole with small holes on the south side.		
238	vertical fracture	8.78	8.87	N to S	tight	tight fracture with broken exterior runs on south side from item 237 to 240		
239	vertical fracture	8.78	8.87	N to S	tight	tight fracture with broken exterior runs on north side from item 237 to 240. may be part of item 238		
240	horizontal fracture	---	8.87	full circumference	tight with holes	fracture is tight on the north side with large broken material on the top north and evident crystals in holes. On south towards bottom of borehole there is also holes with crystals evident.	BA - 28	
241	horizontal fracture	---	8.90	full circumference	tight	tight fracture at crystal change		
242	horizontal fracture	---	8.97	full circumference	open with large holes	open fracture with holes along the entire length. Slits all along the north side are open with several steps and numerous horizontal fractures below. On the south side there are even larger slits but the fractures underneath are not as visible. There is a vertical fracture on the north that is quite open that comes out of the holes on this side. The bottom of the borehole is also extremely broken with large holes. Large amount of water droplets on top of borehole.	BA - 29, BA - 30, & BA - 31	
243	vertical fracture	8.97	9.19	N to S	partially open	open fracture on the south side of the borehole that seems to begin just above item 242 and continues down the side of the borehole.		
244	horizontal fracture	---	8.99	full circumference	tight with holes	tight fracture with ledge appearance. Broken material along borehole. More open holes on the north side of the borehole and tighter on south side.		
245	horizontal fracture	---	9.00	full circumference	tight with holes	small slits on the top north side. Ledge appearance.		
246	vertical fracture	8.97	9.00	N to S	partially open	partially open vertical fracture on north side. Runs through items 242 to 245. Holes where broken areas are. There are several vertical fractures through this area.		
247	horizontal fracture	---	9.09	full circumference	tight	tight fracture with broken material on top of borehole		
248	horizontal fracture	---	9.11	full circumference	tight	tight fracture with ledge appearance. Seems to be intersect by item 249. with water again below it.		
249	vertical fracture	8.97	-0.40	SW to C	tight	tight fracture with broken exterior seems to run from broken area above to item 248.		
250	horizontal fracture	---	9.22	full circumference	tight	tight fracture with crystal change.		
251	vertical fracture	9.22	9.43	N to S	partially open	partially open fracture with hole on the north side where it intersects item 250. Open holes where they meet the bottom of the borehole.		
252	vertical fracture	9.19	9.33	N to S	tight	tight fracture but broken exterior. Runs from item 248		
253	vertical fracture	9.22	9.43	N to S	partially open	partially open fracture on the south side. Seems to be part of item 251.		
254	horizontal fracture	---	9.29	full circumference	tight	tight fracture with broken material along the north side. Holes not as present on south side. Slight crystal change.		

Item #	Feature	Top of Feature (mbss)	Bottom of Feature (mbss)	Orientation	Relative Openness	Description	Video Snapshot	Corresonding Test
255	horizontal fracture	---	9.33	full circumference	tight with holes	fracture similar to item 254 is not as broken on south side but broken away material on north side with small holes in broken areas. Bottom of the borehole has broken away material.		
256	horizontal fracture	---	9.36	full circumference	tight with holes	this fracture is opposite to item 254 and 255 with broken material on south side with little present on south side. Holes in broken material on south side.		
257	vertical fracture	9.33	9.36	E to W	partially open	partially open vertical fracture on top of borehole running from item 255 to 256. Spider webs out near 256 and intersects in large broken area on 256 with visible black staining and crystals in hole.	BA -32	
258	horizontal fracture	---	9.50	full circumference	tight with holes	tight fracture with ledge appearance and small holes at ledge at top of borehole. Fracture does not seem to be as evident near sides and bottom of borehole with the exception of where vertical fractures intersect. Holes and crystals on south. Lots of black staining on the bottom of borehole	BA - 33 & BA - 34	
259	horizontal fracture	---	9.55	full circumference	tight with holes	similar to 258 with two quite open vertical fractures running out of the north side of the borehole towards the bottom.		
260	vertical fracture	9.47	9.68	N to S	open	open fracture with large hole where it meets item 259 and continues to run down the north side of the borehole to bottom.		
261	vertical fracture	9.50	9.72	N to S	open	less open than 260 but with large block that seems to be about to fall out of fracture and crystals behind it. Runs down the north side towards the bottom.		
262	horizontal fracture	---	9.61	full circumference	tight	tight with crystal change		
263	horizontal fracture	---	9.68	full circumference	tight	crystal change		240909-B-Ang-1 Ends
264	horizontal fracture	---	9.79	full circumference	tight	crystal change with dark material above and tighter and lighter material below		240909-B-Ang-2 Begins
265	vertical fracture	9.72	9.89	N to S	tight	tight fracture with broken exterior runs from item 264 down the north side of borehole.		
266	horizontal fracture	---	9.82	full circumference	tight	tight fracture with visible staining and small holes on the north and south side.		
267	horizontal fracture	---	9.86	full circumference	tight with holes	tight with holes and ledge appearance on top. Vert fracture intersects on the north side from item 266.		
268	vertical fracture	9.82	9.93	N to S	tight	two or three tight fractures on the north top side which connect item 266 to 269 with visible dark staining.		
269	horizontal fracture	---	9.93	full circumference	tight with large holes	there are some large holes on the north side where possible vertical fractures intersect. Also some holes along the top where vert fractures intersect. Holes on south side with crystals in some. Bottom of borehole is open and may intersect some vertical fractures.		
270	vertical fracture	9.82	9.93	E to W	tight with holes	tight fracture runs from item 266 to 269 or farther. Holes where it intersects 269		
271	horizontal fracture	---	10.00	full circumference	tight with holes	tight fracture with obvious crystal change with dark yellow material above fracture and tighter dull material below. Broken material along some parts of the fracture.		
272	vertical fracture	9.93	10.03	E to W	tight	tight fracture with visible dark staining running down the borehole on the top.		
273	horizontal fracture	---	10.07	full circumference	tight	tight fracture at crystal change with water droplets at fracture on top. Dark yellow material on top with dull tighter material below.		
274	vertical fracture	9.93	10.07	E to W	tight	tight fracture with broken exterior may be part of item 272 runs from 272 to 273.		
275	horizontal fracture	---	10.13	full circumference	tight	tight fracture with dull material above and below.		
276	horizontal fracture	---	10.18	full circumference	tight	tight fracture with visible staining. Seems to be fracture that runs out of near the bottom of the borehole on the south side.		
277	vertical fracture	10.18	10.32	N to S	partially open	seems to be two or three vertical fractures on the north side that are dark stained and open. May come from item 276.		
278	vertical fracture	10.18	10.39	N to S	tight	tight fracture with visible staining coming out of item 276 and running down the north side of the borehole.		
279	vertical fracture	10.18	10.39	N to S	tight	tight with broken exterior. Seems to be in the same positions 278 but on the south side. From certain view it seems that this fracture goes completely around the hole making a circle.		
280	vertical fracture	10.00	10.39	E to W	partially open	several vertical fractures running E to W along the bottom of the borehole seem to intersect 271 and 279.		
282	horizontal fracture	---	10.42	full circumference	tight	tight fracture intersects 279 at the top of the circle. Small hole on the top of the borehole.		
283	horizontal fracture	---	10.49	full circumference	tight	tight fracture with visible dark staining. Passes through the center of item 280. Hole on the south and north and south side as item 280 passes		
284	horizontal fracture	---	10.53	full circumference	tight	tight fracture that passes through item 280.		
285	horizontal fracture	---	10.56	full circumference	tight	tight fracture with broken material or indentation on sides. Broken where item 280 passes through this fracture		
286	horizontal fracture	---	10.63	full circumference	tight	tight fracture with broken wide band all along the top of the borehole. Blocky yellow crystals in the broken area. Hard to discern fracture on sides of borehole but seems to intersect bottom of item 280		240909-B-Ang-2 Ends
287	horizontal fracture	---	10.67	full circumference	tight	similar to item 286 but is below item 280.		240909-B-Ang-3 Begins
288	vertical fracture	10.56	10.78	N to S	partially open	this fracture seems to run around the borehole similar to item 279 but not as evident. Dark staining and holes where it meets the bottom of the borehole.		
289	horizontal fracture	---	10.71	full circumference	tight	tight fracture with crystal change.		
290	horizontal fracture	---	10.74	full circumference	tight	tight fracture with crystal change		

Item #	Feature	Top of Feature (mbss)	Bottom of Feature (mbss)	Orientation	Relative Openness	Description	Video Snapshot	Corresonding Test
291	horizontal fracture	---	10.78	full circumference	tight	tight fracture with slight ledge appearance, indentation and visible dark staining around the borehole.		
292	vertical fracture	10.78	10.92	E to W	tight	tight fracture with broken exterior. Runs from item 291 down the borehole towards the top north.		
293	horizontal fracture	---	10.85	full circumference	tight	crystal change. Item 292 runs into this fracture and seems to stop.		
294	horizontal fracture	---	10.88	full circumference	tight with holes	tight fracture at crystal change. Holes on sides where vertical fracture item 295 intersects		
295	vertical fracture	10.85	11.06	N to S	tight	tight fracture which intersects 294 and runs down the south side of the borehole towards the bottom		
296	vertical fracture	10.88	11.09	N to S	open	open fracture runs down the south side of the borehole from what seems to be item 294. Open slits all along the south side. Again seems to go all around the borehole.		
297	vertical fracture	10.88	11.09	N to S	partially open	seems to me part of item 296 as the vertical fracture seems to be a full circle around the borehole.		
298	horizontal fracture	---	11.02	full circumference	partially open	in some places this fracture seems to be tight with slight ledge appearance but on the north side there are large slits and broken material which seems open behind it. on the north side it is again open with a slit running for a ways and this continues around the south side. where it meets item 296 there are holes and the slit larger		
299	horizontal fracture	---	11.05	full circumference	partially open	this fracture is just below item 298 and is partially open along its length. There is a ledge appearance between these two fractures and some vertical		
300	horizontal fracture	---	11.09	full circumference	open	this fracture is more open than 298 with large slits on the north side and in some places where there may be vertical connection the material is highly broken with large chunks looking to fall away. On the north side there is a ledge appearance but slightly tighter with visible staining. At the south side there is again large slits that are open for quite a distance. tighter towards the bottom of the borehole but intersects with item 296	BA - 36, BA - 37, & BA - 38	
301	vertical fracture	11.05	11.09	semi hor. N to S	open	very open fracture almost seems horizontal but connects into item 300 from above then runs horizontal where it intersects with 299		
302	horizontal fracture	---	11.13	full circumference	tight with large holes	tight fracture on the north with ledge appearance. On the south and north it intersects some broken material		
303	horizontal fracture	---	11.14	full circumference	tight with holes	tight fracture on the north with small vertical connection with fractures above. Ledge like appearance.		
304	horizontal fracture	---	11.16	full circumference	tight with holes	similar to item 303 and is close to item 303.		
305	vertical fracture	11.05	11.26	N to S	tight	tight fracture with broken exterior runs down from item 299 through all the horizontal fractures below it on the north side of the borehole.		
306	horizontal fracture	---	11.19	full circumference	tight	tight fracture at crystal change with yellow crystals above and tighter material below.		
307	horizontal fracture	---	11.21	full circumference	tight	tight fracture with ledge appearance on top of borehole. South sides has broken away material with small holes with yellows crystals in hole		
308	horizontal fracture	---	11.24	full circumference	tight	tight fracture with crystal change with darker crystals above and lighter tight material below.		
309	vertical fracture	11.19	11.33	N to S	tight	tight fracture on south side with visible dark staining. Runs from item 306 down the south side of the borehole heading in easterly direction		
310	horizontal fracture	---	11.34	full circumference	tight with holes	tight fracture with broken material all along the borehole. Small holes on the north side. Where item 309 intersects on the south there are some holes. Tighter on south side with exception of fracture location. Bottom of borehole is quite broken and open		
311	vertical fracture	11.24	11.45	N to S	partially open	partially open fracture on the north side running down from item 308 into 310 and continues down towards the bottom.		
312	vertical fracture	11.26	---	N to S	tight	tight fracture with broken exterior just beyond item 311 on the north side. Connects from item 308 and runs down toward the bottom.		
313	horizontal fracture	---	11.38	full circumference	tight with holes	holes along the north side where items 311 and 312 intersect. Visible staining along fracture but tight most of the way around. Yellow crystal structures above with tighter material below.		
314	vertical fracture	11.34	---	E to W	tight	tight fracture with broken exterior runs from item 310 down the top of the borehole and runs through to item313.		
315	horizontal fracture	---	11.41	full circumference	tight	tight fracture at crystal change with tight material above and blocky yellow crystals below		
316	horizontal fracture	---	11.50	full circumference	tight	tight fracture with larger blocky material beginning below it		
317	vertical fracture	11.50	11.54	E to W	partially open fracture	fracture runs along the top of the borehole starting at item 316 and continues down the borehole. In some places it is dark stained and in some places it looks to be slightly open. When it reaches the tighter material at 318 it becomes tighter with dark visible dark staining.		
318	horizontal fracture	---	11.54	full circumference	tight	tight fracture with slight crystal change		
319	horizontal fracture	---	11.62	full circumference	tight	tight fracture at crystal change with very yellow blocky material above and tight material below.		240909-B-Ang-3 Ends
320	vertical fracture	11.55	11.73	N to S	tight	tight fracture with broken exterior on the north side. Starts at item 316 and runs down the side of the borehole towards the bottom.		
321	vertical fracture	11.50	11.54	E to W	partially open	seems to run along the same distance as item 317. Near 169 it starts to angle towards the side south side of the borehole and seems to meet up with item 317. on the center of the south side at item 319 where there is a great deal of dark staining.	BA - 39 & BA - 40	
322	horizontal fracture	---	11.77	full circumference	tight	tight fracture with visible dark staining. On south side where item 317 and 321 meet there is also a fracture running N to S above and below the this fracture		
323	vertical fracture	---	11.70	N to S	tight	tight fracture with dark staining runs above and below this fracture along the south side of the borehole		

Borehole **C Vertical** Notes: String on south side of borehole to give orientation
Date Recorded **Oct 2/2009**
Date Analyzed **Dec 14-16/2010**

Item #	Feature	Top of Feature (mbss)	Bottom of Feature (mbss)	Orientation	Location	Relative Openness	Description	Video Snapshot	Corresponding Test
1	vertical fracture	0	0.13	vertical	south	open	black stained vertical fracture intersects horizontal fracture		
2	horizontal fracture	-0.33	0.13	horizontal	full circumference	open	open fracture with black staining. Changing in width		
3	horizontal fracture	-0.33	0.29	horizontal	full circumference	tight	tight fracture with blocky yellow crystal structure above it. On eastern side black staining more visible		
4	horizontal fracture	-0.33	0.32	horizontal	full circumference	open/closed	western side is open with large aperture but only smaller holes on eastern side		
5	horizontal fracture	-0.33	0.35	horizontal	full circumference	tight	crystal structure change/tight fracture. Almost seems like water present on Southern face in droplets		
6	vertical fracture	0.35	0.42	vertical	south	tight	seems to be either vertical fracture that runs from item 5 or possibly just broken crystals		
7	horizontal fracture	-0.33	0.38	horizontal	full circumference	semi tight	tight fracture/ crystal structure change		
8	vertical fracture	0.32	0.59	vertical	North 45 west	tight	starts at item four. At first seems to be broken crystals from packer but as it progressess down the hole seems more like vertical fracture		
9	horizontal fracture	-0.33	0.42	horizontal	full circumference	tight	tight fracture with yellow blocky crystal structure above with porous matrix below		
10	horizontal fracture	-0.33	0.47	horizontal	full circumference	tight	tight with dark staining and crystal structure change with block above and tighter material below		
11	vertical fracture	0.44	0.49	vertical	north	semi tight	block stained vertical fracture running above item 10 intersecting on the northern side. Doesn't look to continue down		
12	horizontal fracture	-0.33		horizontal	full circumference	tight	tight fracture. seems to go all around the hole with black staining present		
13	horiztonal fracture	-0.33	0.51	horizontal	full circumference	partially open/tight	on the eastern side there is a small portion that is very visible and slightly open. The remainder is quite tight, dark stained and in some areas less visible. Seems to be water present		
14	horizontal fracture	-0.33	0.53	horizontal	full circumference	tight	black staining but harder to see. coincides with crystal structure change		
15	horizontal fracture	-0.33	0.59	horizontal	full circumference	tight	crystal structure change with yellow blocky crystals above it and dull porous material below.		
16	horizontal fracture	-0.33	0.63	horizontal	fullcircumference	tight	dark staining		
17	horizontal fracture	-0.33	0.68	horizontal	full circumference	tight	dark staining with water droplets on the fracture face and material adjacent to it on the eastern side		
18	horizontal fracture	-0.33	0.7	horizontal	full circumference	tight with holes	dark staining on actual fracture face with yellow blocky crystals above fracture		
19	vertical fracture	0.63	0.7	vertical	east 45 south	partially open	tight fracture but defined dark staining almost slightly open.		
20	vertical fracture	0.68	0.74	vertical	east 50 south	partially open	tighter than item 19 and not as obvious dark staining		
21	vertical fracture	0.68	0.7	vertical	east 60 south	partially open	dark staining and seemingly tight		
22	vertical fracture	0.68	0.74	vertical	south	partially open	looks to be broken crystals around the fracture opening. Larger exterior opening but may have been more open due to damage.		
23	horizontal fracture	-0.33	0.74	horizontal	full circumference	tight	dark staining but fairly tight with small holes		
24	vertical fracture	0.74	0.77	vertical	west	tight	dark staining but staining has larger width		
25	vertical fracture	0.74	0.82	vertical	west	tight	broken exterior but hard to see dark staining. Starts at the same location as item 24 and runs from their towards the south		
26	horizontal fracture	-0.33	0.77	horizontal	full circumference	tight	tight with dark staining through zone of crystal structure change		
27	horizontal fracture	-0.33	0.82	horizontal	full circumference	tight	dark staining with crystal structure change. Yellow block crystals above and tighter material below.		
28	horizontal fracture	-0.33	0.88	horizontal	full circumference	tight	tight with little dark staining. Small holes on western side with larger hole on northern side. With vertical fracture from above it. Tight on eastern side.		
29	vertical fracture	0.82	0.88	vertical fracture	north	tight	tight with little staining. Runs from item 27 to 28 and lines up with hole on northern side.		
30	vertical fracture	0.88	0.93	vertical	west	tight	tight dark stained fracture with no defined starting point. Looks light it might start at item 29		
31	horizontal fracture	-0.33	0.93	horizontal	full circumference	tight	tight with dark staining some small holes around the circumference		
32	horizontal fracture	-0.33	0.96	horizontal	full circumference	tight	larger band of dark staining but still tight on western side. Eastern side can still make out fracture but more so due to banding.	CV - 1	
33	vertical fracture	0.88	1.1	vertical	western	tight	broken exterior with dark staining. More visible portion of the fracture seems to end at item 32 but turns toward the south and can still make out fracture orientation due to dark spots on wall.	CV - 2	
34	vertical fracture	0.96	1.13	vertical	northern	tight	little dark staining. This fracture does not stop at item 35 but at this point becomes three small tight dark stained fractures	CV - 4	
35	horizontal fracture	-0.33	1.02	horizontal	full circumference	tight with holes	tight fracture with dark staining. On western side small holes with dark material below the hole possibly created as water exited the holes.	CV - 3	090909-C-Vert-1 Begins
36	vertical fracture	0.96	1.02	vertical	eastern	tight	broken exterior with little visible staining		
57	horizontal fracture	-0.33	1.1	horizontal	full circumference	tight	light banding with smalland larger holes on the western side		
58	vertical fracture	1.1	1.22	vertical	northern	tight	dark stained fractures. Two of the three fractures from itm 34 stop at this depth but one of the fractures continues on. Disperses laterally into small vesicle like fractures at 1.55 and contiues for a cm or two.		
59	horizontal fracture	-0.33	1.13	horizontal	full circumferene		blocky yellow crystals between item 57 and this area with tighter material below it.		
60	horizontal fracture	-0.33	1.16	horizontal	full circumference	tight	blocky crystal structure above with light staining although tight. Tighter material below with holes in the matrix. Water droplets present on matrix.		
61	horizontal fracture	-0.33	1.22	horizontal	full circumference	tight	tight with larger dark banded area. Small holes on southern and western sides. Dark blocky yellow crystals above this fracture.		

Item #	Feature	Top of Feature (mbss)	Bottom of Feature (mbss)	Orientation	Location	Relative Openness	Description	Video Snapshot	Corresponding Test
62	vertical fracture	1.22	1.44	vertical	northern	tight	dark stained fracture begins at at the depth of item 63 but becomes less visible. May continue as the area below item 63 is riddled with holes. This fracture breaks into the small vesicle like fractures		
63	horizontal fracture	-0.33	1.26	horizontal	full circumference	tight	the area below this fractures is riddled with holes that may be the visible portion of vertical fractures. Dark staining but tight.		
64	vertical fracture	1.22	1.26	vertical	northern	tight	this may just be a continuation from item 58.		
65	vertical fracture	1.26	1.5	vertical	western	partially open with holes	broken exterior zone with a great deal of the larger fracture being dark stained. And visible water on this dark stained area		
66	horizontal fracture	-0.33	1.29	horizontal	full circumference	tight with large holes	tight fracture not visible on all sides but large holes along its length. Particularly on the southern and eastern sides		
67	horizontal fracture	-0.33	1.32	horiontal	full circumference	tight	hard to define fracture but indentation along the borehole seems to indicate fracture and on northern side there is a large hole where a vertical fracture starts.		
68	vertical fracture	1.32	1.53	vertical	northern	tight	fracture comes out of larger hole on the northern side of item 67. dark staine but tight	CV - 5	
69	horizontal fracture	-0.33	1.37	horizontal	full circumference	tight	larger stained band. There are most likely horizontal fractures above this but it is difficult to tell due to what seems to be dust.		
70	vertical fracture	1.32	1.53	vertical	western	partially open with holes	broken exterior on fracture with dark staining.		
71	vertical fracture	1.41	1.5	vertical	southern	tight	tight fracture with little visible staining		
72	horizontal fracture	-0.33	1.41	horizontal	full circumference	tight	crystal structure change		
73	horizontal fracture	-0.33	1.45	horizontal	full circumference	tight	crystal structure change		
74	horizontal fracture	-0.33	1.5	horizontal	full circumference	tight	tight with dark staining and crystal structure change with yellow blocky crystals		
75	vertical fracture	1.5	1.53	vertical	south	tight with large holes	vertical fracture is hard to define other than indentation and large holes along its length. No visible staining.		
76	vertical fracture	1.41	1.59	vertical	eastern side	tight	tight with some visitble staining. Large broken exterior		
77	horizontal fracture	-0.33	1.53	horizontal	full circumferene	tight with large holes	large holes along the length of the fracture where some of the vertical fractures interesect. Crystal structure change.		
78	vertical fracture	1.53	1.68	vertical	western	tight	seems that it may have been continuation of item 70. but in this area the fracture is tighter with no broken exterior.		
79	horizontal fracture	-0.33	1.56	horizontal	full circumference	tight	crystal structure change		
80	horizontal fracture	-0.33	1.59	horizontal	full circumference	tight	tight with dark staining		
81	horizontal fracture	-0.33	1.62	horizontal	full circumference	tight	between this horizontal fracture and the one above there is a great deal of holes within the yellow blocky crystals. This happens all throughout the borehole		
83	horizontal fracture	-0.33	1.65	horizontal	full circumference	tight	tight fracture noticeable at crystal structure change		
84	vertical fracture	1.65	1.73	vertical	east	tight	tight fracture with dark staining		
85	vertical fracture	1.73	1.84	vertical	northern	tight	tight fracture with dark staining		
86	horizontal fracture	-0.33	1.68	horizontal	full circumference	tight	crystal structure change		
87	horizontal fracture	-0.33	1.73	horizontal fracture	full circumference	tight	tight with visible dark staining. Can only see crystal structure change on east no dark staining. Large holes on south and eastern side.		
88	horizontal fracture	-0.33	1.78	horizontal	full circumference	tight	hard to see if the fracture is open at all but can differentiate the crystal structure change		
89	vertical fracture	1.78	1.82	vertical	south eastern side	tight	no visible staining but broken exterior		
90	horizontal fracture	-0.33	1.82	horizontal	full circumference	tight	tight fracture with visible dark staining		
91	horizontal fracture	-0.33	1.85	horizontal	full circumference	tight	tight fracutre with little visible staining but on the western side you can see some larger dark spots that almost look like holes.		
92	horizontal fracture	-0.33	1.88	horizontal	full circumference	tight	tight with crystal structure change		
93	vertical fracture	1.88	2	vertical fracture	western	tight	tight with little visible dark staining		
94	horizontal fracture	-0.33	1.91	horizontal	full circumference	tight	tight with crystal structure change		
95	vertical fracture	1.91	2	vertical	south	tight	tight with broken exterior		
96	horizontal fracture	-0.33	1.97	horizontal	full circumference	tight	tight with dark staining		
97	vertical fracture	2	2.09	vertical	south western	tight	tight with broken exterior		
98	horizontal fracture	-0.33	2.02	horizontal	full cirumference	tight	small holes where vertical fractures intersect and yellow blocky crystals with tighter material below it.		
99	vertical fracture	2	2.05	vertical	east	tight	broken exterior with tight fracture. No visible dark staining.		
100	horizontal fracture	-0.33	2.05	horizontal	full circumference	tight	tight with dark staining on the western and southern walls. There is tight matrix material above and below it.		
101	horizontal fracture	-0.33	2.07	horizontal	full circumference	tight	tight fracture but dark visible fracture face		
102	horizontal fracture	-0.33	2.09	horizontal	full circumference	tight	tight fracture with visible dark staining but harder to see on the southern half of the borehole.		
103	vertical fracture	2.07	2.11	vertical	northern	tight	tight with visible dark staining		
103	horizontal fracture	-0.33	2.11	horizontal	full circumference	partially open with large holes	the fracture is indented into the wall with large holes spaced along its length. In between the holes the fractures is either infilled or tighter		
104	horizontal fracture	-0.33	2.14	horizontal	full circumference	tight	tight fracture with black staining only visible in specific locations		
105	horizontal fracture	-0.33	2.16	horizontal	full circumference	tight	tight fracture with black staining only visible in specific locations		

Item #	Feature	Top of Feature (mbss)	Bottom of Feature (mbss)	Orientation	Location	Relative Openness	Description	Video Snapshot	Corresponding Test
106	vertical fracture	2.14	2.32	vertical	east	tight	tight with broken exterior		
107	horizontal fracture	-0.33	2.23	horizontal	full circumference	tight	small holes all around the borehole with black staining along the western and a portion of the northern side. On the eastern side there is some large holes that coincide with a vertical fracture	CV - 6	
108	vertical fracture	2.23	2.3	vertical	south east	tight	tight fracture with broken exterior		
109	horizontal fracture	-0.33	2.26	horizontal	full circumferene	tight	area of crystal structure change		
110	vertical fracture	2.26	2.3	vertical	west	tight	tight fracture with a bit of black staining		
110	horizontal fracture	-0.33	2.3	horizontal	full circumference	tight with holes	tight fracture with little visible banding and large and small holes spaced along the fracture		
111	vertical fracture	2.3	2.43	vertical	west	tight with small holes	small holes can be seen along this fracture.		
112	horizontal fracture	-0.33	2.32	horizontal	full circumference	tight with large holes	there seems to be holes that align with this fracture on the western side but along the northern and eastern sides the holes are above the fracture.		
113	horizontal fracture	-0.33	2.36	horizontal	full circumference	tight	little visible dark staining but fairly tight. Water present on norther side of the fracture.		
114	vertical fracture	2.36	2.39	vertical	north	tight	little visible dark staining but fairly tight. On northern side the fracture intersects two holed areas. On the eastern edge there is some very large holes that intersect a fracture that is running south east.		
115	horizontal fracture	-0.33	2.39	horizontal	full circumference	tight	little visible dark staining but fairly tight		
116	vertical fracture	2.36	2.49	vertical	south	tight with holes	fracture has broken exterior with holes along fracture		
117	vertical fracture	2.32	2.43	vertical	east		looks like this might be a continuation of 106		
118	horizontal fracture	-0.33	2.43	horizontal	full circumference	tight with large holes	the fracture is tight in most places with large holes in some locations. Water present along the fracture face.		
119	vertical fracture	2.43	2.49	vertical	west	tight with large holes	this seems to be part of item 111 but at this depth it seems to enlarge. The exterior broken face is wider and the fracture more open. Just above item 122 the fracture seems darker with larger holes		
120	vertical fracture	2.39	2.49	vertical	northern	tight	visible dark staining		
121	vertical fracture	2.39	2.49	vertical	east	tight with holes	vertical fracture seems to start in the east and head toward the north and then go vertical again		
122	horizontal fracture	-0.33	2.49	horizontal	full circumference	tight	very evident texture change from blocky yellow crystals to a tighter matrix		090909-C-Vert-1 Ends
123	vertical fracture	2.49	2.57	vertical	west	tight	this seems to be part of item 119 but the fracture becomes tighter at this depth		180909-C-Vert-1 Begins
124	vertical fracture	2.49	2.57	vertical	north eastern	tight	this is part of item 121. The curve ends at the north eastern side and becomes tighter at this depth.		
125	vertical fracture	2.49	2.57	vertical	north	tight	this is part of item 120 but becomes tighter at this depth		
126	horizontal fracture	-0.33	2.57	horizontal	full circumferene	tight	tight fracture with little visible staining. On the western side there is a larger opening where it intersects with the vertical fracture item 123.		
127	horizontal fracture	-0.33	2.61	horizontal	full circumference	tight	tight fracture with small holes on the west at the intersection of fracture item 123. on east hard to notice except for holes.		
128	vertical fracture	2.57	2.64	vertical	south	tight	tight fracture with a bit of dark staining.		
129	horizontal fracture	-0.33	2.64	horizontal	full circumference	tight	tight fracture with material below and above it being quite tight. Large hole below this fracture on the north at about a depth of 2.64.	CV - 7	
130	horizontal fracture	-0.33	2.68	horizontal	full circumference	tight	slight texture change but mainly noticeable because of dark staining on eastern side.		
131	horizontal fracture	-0.33	2.75	horizontal	full circumference	tight	tight fracutre with little visible dark staining.		
132	vertical fracture	2.68	2.75	vertical	south west	tight	tight very small fracture with dark staining. Just below this depth the fracture seems to disperse outwards		
133	vertical fracture	2.75	2.8	vertical	north	tight	tight fracture with dark staining and somewhat broken exterior.		
134	vertical fracture	2.68	2.8	vertical	south	tight	tight fracture but larger broken exterior		
135	horizontal fracture	-0.33	2.8	horizontal	full circumference	tight	tight fracture with yellow blocky crystals above the fracture. Larger holes on south and western sides where vertical fractures intersect		
136	vertical fracture	2.8	2.94	vertical	west	tight	this fracture seems to have been part of other fracture above item 132 but becomes tighter here.		
137	vertical fracture	2.8	2.94	vertical	north	partially open	large broken area where the fracture interesects the horizontal fracture at around item 135		
138	horizontal fracture	-0.33	2.87	horizontal	full circumference	tight	tight fracture can see some dark staining but not evident everywhere.		
139	horizontal fracture	-0.33	2.91	horizontal	full circumference	tight	very evident crystal structure change from the tighter dull matrix color to the blocky yellow crystals.		
140	horizontal fracture	-0.33	2.94	horizontal	full circumference	tight	small holes where the fractures on the west and north intersect. End of the blocky yellow crystals from above and tighter material below which may be why the fractures on north and west seem to end or change here.		
141	horizontal fracture	-0.33	2.97	horizontal	full circumference	tight	hard to distinguish fracture and not picked up in original recording. But seems to be where vertical fractures on south start		
141	vertical fracture	2.97	3.03	vertical	south	tight	tight small fracture that is not straight but looks meandering and heads from south east towards the south		
142	vertical fracture	2.97	3.03	vertical	south	tigh with large holes	this fracture is very broken on the exterior with holes along its length		
143	vertical fracture	3.03	3.08	vertical	south east	tight	fracture runs from south east towards the south to meet up with item 141.		
144	horizontal fracture	-0.33	3.03	horizontal	full circumference	tight	hard to notice except for small dark staining where item 145 starts and c ouple of small holes around the borehole.		
145	horizontal fracture	-0.33	3.08	horizontal	full circumference	tight	definite texture change with small dark spots spaced along it.		

Item #	Feature	Top of Feature (mbss)	Bottom of Feature (mbss)	Orientation	Location	Relative Openness	Description	Video Snapshot	Corresponding Test
146	vertical fracture	3.08	3.11	vertical	south	tight	items 141 and 143 seem to meet and this fracture continues on from their meeting location.		
147	horizontal fracture	-0.33	3.11	horizontal	full circumference	tight	this is again a texture change from item 145. The material goes from tight material below item 145 and becomes blocky yellow cyrstals just above this depth		
148	vertical fracture	3.11	3.28	vertical	south	tight	fracture from item 146 seems to jog over. Tight fracture with dark staining.		
149	horizontal fracture	-0.33	3.18	horizontal	full circumference	tight	tight fracture with dark staining.		
150	horizontal fracture	-0.33	3.22	horizontal	full circumferene	tight	the fracture is hard to see except for some small holes on the south and some on the west.		
151	vertical fracture	3.11	3.32	vertical	north	tight	tight with small holes along the fracture.		
152	horizontal fracture	-0.33	3.28	horizontal	full circumference	tight	tight fracture with little visible staining but holes spaced out along the fracture.		
153	vertical fracture	3.28	3.41	vertical	west	tight with holes	this fracture is tight broken exterior		
154	horizontal fracture	-0.33	3.32	horizontal	full circumference	tight	hard to see but seems to be a crystal structer change		
155	horizontal fracture	-0.33	3.41	horizontal	full circumference	tight with large holes	there are holes all around this fracture. with little visible dark staining.		
156	vertical fracture	3.41	3.59	vertical	west	tight	this seems to be continuation from 153 but becomes tighter at this depth.		
157	horizontal fracture	-0.33	3.47	horizontal	full circumference	tight	hard to notice and didn't pick it up in original recording. Indicated by texture change.		
158	horizontal fracture	-0.33	3.49	horizontal	full circumference	tight	texture change		
159	vertical fracture	3.47	3.59	vertical	south west	tight with holes	broken exterior with visible dark staining.		
160	vertical fracture	3.47	3.59	vertical	east	tight with holes	part of very broken area but fracture itself actually looks quite tight		
161	vertical fracture	3.47	3.59	vertical	north	tight with holes	this fracture actually inclines from the north to the west and has wide broken face (exterior).	CV - 8	
162	horizontal fracture	-0.33	3.54	horizontal	full circumference	tight	little visible dark staining with texture somewhat noticeable.		
163	horizontal fracture	-0.33	3.59	horizontal	full circumference	tight	this fracture ends a layer of banding and broken material. Large portion of this material is yellow blocky crystals. Below this fracture the material becomes tighter again. All of the vertical fractures that are very obvious through the above banded area seem to stop here. There are some large holes present along this fracture especially at the intersection of vertical fractures.		
164	horizontal fracture	-0.33	3.62	horizontal	full circumference	tight	evident by crystal structure change. Tight fracture with little visible staining.		
165	horizontal fracture	-0.33	3.66	horizontal	full circumference	tight	visible by dark staining along the fracture with holes on the fracture face on the western side. Holes also below it between it and the next horizontal fracture.		
166	horizontal fracture	-0.33	3.69	horizontal	full circumference	tight with large holes	on the south side there are large holes. On the north west side there are large holes and chunks which look like they may spall off because of the fracture which intersects here. Large holes on the north and on the east.		
167	vertical fracture	3.66	3.69	vertical	north west	tight with large holes	this fracture seems to come out of some of the holes from the fracture above item 165 and again creates large holes where it intersects item 166.		
168	horizontal fracture	-0.33	3.71	horizontal	full circumference	tight	tight fracture barely noticeable just below the broken area above.		
169	horizontal fracture	-0.33	3.79	horizontal	full circumference	tight	small holes on the west and south side.		
170	horizontal fracture	-0.33	3.83	horizontal	full circumference	tight	little visible staining but quite tight.		
171	vertical fracture	3.83	3.93	vertical	west	tight	broken exterior with no visible staining and tight		
172	horizontal fracture	-0.33	3.85	horizontal	full circumference	tight	fracture is tight and just below bit of broken banded area.		
173	vertical fracture	3.83	3.93	vertical	south 70 west	tight	broken exterior with little visible staining. Seems to start from hole at item 170. there are small holes along the length of the fracture.		
174	horizontal fracture	-0.33	3.87	horizontal	full circumference	tight with large holes	the fracture is hard to see but there are small holes along the east side with a larger hole on the north side.		180909-C-Vert-1 Ends
175	horizontal fracture	-0.33	3.93	horizontal	full circumference	tight	tight fracture with little visible staining. The blocky yellow matrix above this fracture is riddled with holes and the fractures all seem to stop at this location as the material below it is tight dull yellow matrix.		180909-C-Vert-2 Begins
176	horizontal fracture	-0.33	3.95	horizontal	full circumference	tight	hard to see fracture especailly on east side. Can see indentations along west and north side.		
177	horizontal fracture	-0.33	4.01	horizontal	full circumference	tight	tight on the west and north side with some banding and broken areas and holes above it on the north east side.		
178	vertical fracture	3.99	4.04	vertical	north east	tight with holes	begins from large holes above item 177 and continue down.		
179	horizontal fracture	-0.33	4.04	horizontal	full circumference	partially open with large holes	this fracture is evident by large holes constant along its length and by the broken away material at this depth.		
180	vertical fracture	4.04	4.09	vertical	north	tight	small fracture begins from a hole just below item 179.		
181	horizontal fracture	-0.33	4.09	horizontal	full circumference	tight	tight fracture with small holes		
182	vertical fracture	4.13	4.16	vertical	south	tight with small holes	this fracture lookes like it would be quite open if not for the blocks of material that look to spall of it right in front of it.		

Item #	Feature	Top of Feature (mbss)	Bottom of Feature (mbss)	Orientation	Location	Relative Openness	Description	Video Snapshot	Corresponding Test
183	horizontal fracture	-0.33	4.13	horizontal	full circumference	partially open	this item and item 185 seem to border an area of broken material with vertical connections spaced throughout.		
184	vertical fracture	4.13	4.22	vertical	west	tight with small holes	broken exterior with tight fracture.		
185	horizontal fracture	-0.33	4.16	horizontal	full circumference	partially open	look at comments for item 183		
186	vertical fracture	4.13	4.22	vertical	north	tight with small holes	this fracture starts out of some larger holes and there is large holes present where it intersects. Where it intersects it is broken.		
187	vertical fracture	4.13	4.22	vertical	south	tight	broken exterior with tight fracture		
188	horizontal fracture	-0.33	4.17	horizontal	full circumferene	tight	tight with some broken portions. This fracture is the upper boundary again of a somewhat broken zone.		
189	horizontal fracture	-0.33	4.22	horizontal	full circumference	tight	bottom boundary of broken zone with holes along the fracture. Most of the vertical fractures seem to end at this zone as the material gets tighter.	CV - 9	
190	horizontal fracture	-0.33	4.25	horizontal	full circumference	tight	tight fracture with dark staining on south side.		
191	vertical fracture	4.25	4.83	vertical	west	tight with holes	out of item 190 comes a tight dark stained fracture that has smaller fractures coming out of it. Spiderwebs. As it gets past the 4.85 mark it becomes larger with broken exterior and small holes along its face. At around 4.9 it starts to get larger and branches into two larger fractures with smaller fractures as off shoots.		
192	horizontal fracture	-0.33	4.28	horizontal	full circumference	tight	lightly visible dark staining. Change in crystal structure. Small holes along fracture.		
193	horizontal fracture	-0.33	4.33	horizontal	full circumference	partially open	this fracture is partially open with large holes where the fractures from above intersect.		
194	vertical fracture	4.25	4.54	vertical	South	partially open with small holes	this fracture has a broken exterior, dark staining and partially open.		
195	vertical fracture	4.25	4.33	vertical	east	tight with small holes	this fracture has a broken exterior face with dark staining and small holes along length. Where intersects can see holes at item 194.		
196	horizontal fracture	-0.33	4.46	horizontal	full circumference	partially open with holes	there are large holes where the fractures from above intersect. The south fracture jogs over to the west and continues down vertically. The east is tighter. There are areas on the north east that are quite broken with large holes.		
197	vertical fracture	4.46	4.52	vertical	north	tight	there is a small fracture that looks to be part of the broken zone.		
198	horizontal fracture	-0.33	4.5	horizontal	full circumference	tight	crystal structure change with yellow blocky crystals below it. Holes where fractures intersect.		
199	horizontal fracture	-0.33	4.52	horizontal	full circumference	tight	see comment item 198. This is the bottom boundary of yellow blocky crystals.		
200	horizontal fracture	-0.33	4.56	horizontal	full circumference	tight	open on the west side where the vertical fracture intersects and jogs over. The south and east are tighter. Little visible banding.		
201	horizontal fracture	-0.33	4.58	horizontal	full circumference	tight	hard to notice fracture all the way around but on the south and east you can see the crystal change from yellow blocky above to small area of tighter material below.		
202	vertical fracture	4.54	4.72	vertical	north	tight	fracture comes out of hole in the borehole wall and contiues down. Little visible staining and tight.		
203	horizontal fracture	-0.33	4.66	horizontal	full circumference	tight	indicated by small holes along fracture face.		
204	horizontal fracture	-0.33	4.72	horizontal	full circumference	tight	small holes where the fractures intersect. Crystal structur change. Some areas on the west you can see black staining.		
205	horizontal fracture	-0.33	4.78	horizontal	full circumference	tight	crystal structure change. With small holes.		
206	horizontal fracture	-0.33	4.83	horizontal	full circumference	tight	the broken area above seems to end here and so do the vertical fractures on the west. There are large portions missing where the vert meets the horz. On the west side. Material below the fracture is tight dull yellow matrix and above is blocky yellow crystals.		
207	horizontal fracture	-0.33	4.87	horizontal	full circumference	tight	tight fracture but dark staining on fracture face.		
208	vertical fracture	4.87	4.93	vertical	north	tight with holes	fracture comes out of hole at item 207 and is tight along length with little visible staining and broken exterior. Holes along length.		
209	horizontal fracture	-0.33	4.89	horizontal	full circumference	tight with holes	hard to see but there are indentations and holes along length of fracture.		
210	horizontal fracture	-0.33	4.93	horizontal	full circumference	tight	dark staining all around borehole.		
211	horizontal fracture	-0.33	4.96	horizontal	full circumference	tight	hard to see. Indentations along face.		
212	horizontal fracture	-0.33	4.98	horizontal	full circumference	tight	can see dark staining but tight fracture.		
213	vertical fracture	4.96	5.01	vertical	west	tight	hard to notice the fracture except for lightly visible staining and holes where intersects next horizontal fracture. actually looks like two fractures one straight verfical and part goes down towards the north. End at same place.		
214	horizontal fracture	-0.33	5.01	horizontal	full	tight	dark staining. Can see blocky yellow crystals where fracture intersects. Holes on the west, north. Crystral structure change.		
215	vertical fracture	5.01	5.11	vertical	west towards south	tight with holes	vertical fracture seems to be inclined towards the south. Broken exterior with small holes.		
216	horizontal fracture	-0.33	5.03	horizontal	full circumference	tight	tight fracture. Vertical fractures seem to be the only place where there are holes along this fracture.		
217	horizontal fracture	-0.33	5.08	horizontal	full circumference	large holes	along the fracture there is a lot of broken off material. There are holes and indentations all along the fracture with some vertical fractures starting at these holes. The face of the fracture exterior is broken.		
218	vertical fracture	5.08	5.11	vertical	east	small holes	wide broken exterior with small holes along the fracture.		
219	horizontal fracture	-0.33	5.11	horizontal	full circumference	large holes	the fracture seems to be through an area of broken material and large crystals. Holes where the fractures are present. On the south side there are not as many holes and it is much tighter.		

Item #	Feature	Top of Feature (mbss)	Bottom of Feature (mbss)	Orientation	Location	Relative Openness	Description	Video Snapshot	Corresponding Test
220	vertical fracture	5.11	5.17	vertical	west	small holes	this fracture has broken exterior with small holes along its length. Also slightly inclined towards the south.		
221	horizontal fracture	-0.33	5.15	horizontal	full circumference	tight with large holes	the fracture is tight in places where there aren't large holes. In some areas the material seems to be sloughing off the wall around this depth. Fracture intersections have large holes.		
222	vertical fracture	5.11	5.25	vertical	north	tight	fracture on north is in sloughing zone and is tight with dark staining along fracture		
223	vertical fracture	5.11	5.25	vertical	south	tight	the fracture seems tight. Broken exterior with small holes along length		
224	horizontal fracture	-0.33	5.25	horizontal	full circumference	large holes	this fracture has extremely large hole on west side North and the south side there are some large holes.	CV - 10	180909-C-Vert-2 Ends
225	vertical fracture	5.25	5.34	vertical	west	tight with small holes	broken exterior on vert fracture with small holes along length.		180909-C-Vert-3 Begins
226	horizontal fracture	-0.33	5.34	horizontal	full circumference	tight with small holes	tighter fracture with indentations and crystal structure change with blocky yellow matrix above.		
227	horizontal fracture	-0.33	5.4	horizontal	full circumference	tight	tight fracture with visible black staining only on small portion of the fracture. Can see slight crystal change.		
228	horizontal fracture	-0.33	5.47	horizontal	full circumference	tight	tight fracture with large holes just below it in a blocky yellow crystal structure zone. There are numerous fractures that come from it to the fracture below		
229	vertical fracture	5.47	5.52	vertical	south	tight with small holes	tight fracture with small holes along its length. Seems to start out of a small hole at item 228.		
230	vertical fracture	5.47	5.52	vertical	south west	tight	tight fracture inclined towards the south with large holes at the bottom where it intersects item 228		
231	vertical fracture	5.47	5.52	vertical	west	tight with small holes	there are some broken areas along the fracture where you can see small holes.		
232	vertical fracture	5.47	5.52	vertical	north	small holes	the fracture seems to be a break between material that is spalling or crushed in the area between item 228 and the bottom of this fracture.		
233	horizontal fracture	-0.33	5.56	horizontal	full circumference	large holes	there are many holes around this fracture. Very large fractures in the north to north east. Maybe a cm aperture. Large holes form where fractures intersect. Blocky yellow crystal structure above this fracture in the broken area. Fractures seem to end as below the fracture the material seems tighter dull matrix.	CV - 11 & CV - 12	
234	horizontal fracture	-0.33	5.56	horizontal	full circumference	tight	tight fracture with small holes on east		
235	vertical fracture	5.56	5.64	vertical	east	tight	broken exterior and tight fracture		
236	horizontal fracture	-0.33	5.59	horizontal	full	tight	tight fracture with small holes at fractures and spaced along holes		
237	horizontal fracture	-0.33	5.61	horiztonal	full	tight	tight fracture		
238	horizontal fracture	-0.33	5.64	horizontal	full	tight	tight fracture with small holes along its length.		
239	vertical fracture	5.56	5.64	vertical	north	tight	broken exterior with tight fracture.		
240	horizontal fracture	-0.33	5.71	horizontal	full	tight	tight fracture hard to see except for holes indentation.		
241	horizontal fracture	-0.33	5.81	horizontal	full	tight	tight fracture with very small fractures spidering up and down off of it.		
242	vertical fracture	5.71	5.86	vertical	east	tigh with small holes	tight fracture with small holes and broken exterior.		
243	horizontal fracture	-0.33	5.86	horizontal	full	tight	tight fracture with little visible staining.		
244	horizontal fracture	-0.33	5.92	horizontal	full	tight	tight fracture with indentation		
245	horizontal fracture	-0.33	5.98	horizontal	full	tight	tight fracture with indentation		
246	vertical fracture	5.98	6.13	vertical	west	tight	slightly broken exterior with little visible black staining.		
247	horizontal fracture	-0.33	6.03	horizontal	full	tight	tight with small holes along length. Lightly visible dark staining.		
248	horizontal fracture	-0.33	6.09	horizontal	full	tight	tight with small holes and slight crystal change.		
249	horizontal fracture	-0.33	6.13	horizontal	full	tight	tight with small holes and slight crystal change		
250	vertical fracture	6.13	6.17	vertical	south	tight	tight fracture with small broken exterior		
251	horizontal fracture	-0.33	6.19	horizontal	full	tight	tight with small holes and slight crystal change		
252	horizontal fracture	-0.33	6.22	horizontal	full	tight	crystal structure change and small holes.		
253	vertical fracture	6.13	6.22	vertical	east	tight	slight broken exterior		
254	horizontal fracture	-0.33	6.32	horizontal	full	tight	tight with small holes, slight crystal change and slight dark staining.		
255	horizontal fracture	-0.33	6.34	horiztonal	full	tight	tight with small holes and slight dark staining.		
256	horizontal fracture	-0.33	6.39	horizontal	full	tight	slight dark staining		
257	vertical fracture	6.39	6.61	vertical	east	tight	slight broken exterior		
258	horizontal fracture	-0.33	6.44	horizontal	full	tight	tight fracutre with holes around borehole		
259	vertical fracture	6.44	6.51	vertical	south	tight	slightly broken exterior with yellow blocky crystals exposed.		
260	horizontal fracture	-0.33	6.46	horizontal	full	tight	slight texture change.		
261	horizontal fracture	-0.33	6.51	horizontal	full	tight	tight with slight dark staining.		
262	horizontal fracture	-0.33	6.56	horizontal	full	tight	visible dark staining.		
263	horizontal fracture	-0.33	6.58	horizontal	full	tight	tight fracutre with crystal change		

Item #	Feature	Top of Feature (mbss)	Bottom of Feature (mbss)	Orientation	Location	Relative Openness	Description	Video Snapshot	Corresponding Test
264	vertical fracture	6.58	6.68	vertical	north	tight	tight with slight broken exterior.		
265	vertical fracture	6.58	6.63	vertical	west	tight	slight broken exterior with yellow crystals exposed.		
266	horizontal fracture	-0.33	6.63	horizontal	full	tight with holes	fracture is indicated by holes around wall and by change in crystals.		
267	vertical fracture	6.58	6.63	vertical	south	tight	borken exterior with crsytals exposed.		
268	vertical fracture	6.58	6.68	vertical	east	tight	broken exterior with slight dark staining and crystals exposed.		180909-C-Vert-3 Ends
269	horizontal fracture	-0.33	6.68	horizontal	full	holes	fracture is tight with exception of small and large holes all along its length		180909-C-Vert-4 Begins
270	horizontal fracture	-0.33	6.74	horizontal	full	tight	evident crystal change with small holes. Slight dark staining.		
271	vertical fracture	6.74	6.78	vertical	south west	tight	tight fracture with broken exterior.		
272	vertical fracture	6.78	6.82	vertical	south	tight	tight with broken exterior and exposed yellow crystals.		
273	horizontal fracture	-0.33	6.78	horizontal	full	tight with holes	evident crystal change and indentation. Holes along length		
274	vertical fracture	6.78	6.82	vertical	north	tight	tight with slightly broken exterior		
275	horizontal fracture	-0.33	6.82	horizontal	full	tight with holes	tight with holes especially where vertical fractures are intersected		
276	vertical fracture	6.82	6.94	vertical	west	tight with holes	fracture face is broken (broken exterior) with chunks of crystals broken away.		
277	horizontal fracture	-0.33	6.86	horizontal	full	tight	tight with change in crystals and small holes along fracture		
278	horizontal fracture	-0.33	6.9	horizontal	full	tight	tight with change in texture from blocky yellow crystals to tight material		
279	vertical fracture	6.9	6.98	vertical	north	tight	tight fracture with broken exterior		
280	vertical fracture	6.9	6.98	vertical	east	tight with holes	tight fracture with small holes along length		
281	horizontal fracture	-0.33	6.94	horizontal	full	large holes	area of banding and yellow blocky crystals with large holes along fracture. north side a little tighter		
282	horizontal fracture	-0.33	6.98	horizontal	full	large holes	bottom boundary of the banding and crystal structure change with holes along fracture		
282	vertical fracture	6.94	7.3	vertical	north	small holes	fracture comes out of a hole with broken material along fracture		
283	horizontal fracture	-0.33	7.08	horizontal	full	tight	tight with visible dark staining		
284	horizontal fracture	-0.33	7.12	horizontal	full	tight	tight fracture with dark staining.		
285	vertical fracture	7.08	7.18	vertical	west	tight	tight with broken exterior		
286	horizontal fracture	-0.33	7.12	horizontal	full	tight	tight with small holes and slightly visible dark staining.		
287	horizontal fracture	-0.33	7.14	horizontal	full	tight with holes	small holes along the fractures. Cyrstal change		
288	horizontal fracture	-0.33	7.18	horizontal	full	tight	tight with tight matrix material material		
289	vertical fracture	7.18	7.3	vertical	north	tight	fracture comes out of hole and inclines toward tiem 282 where it meets up at next horizontal fracture		
290	vertical fracture	7.14	7.3	vertical	west	tight	tight fracture with small holes		
291	horizontal fracture	-0.33	7.3	horizontal	full	tight with holes	the western and northern sides have holes where vertical fractures intersect		
292	horizontal fracture	-0.33	7.33	horizontal	full	tight with holes	holes where fractures intersect. Slight visible dark staining.		
293	vertical fracture	7.33	7.58	vertical	north	tight will holes	the fracture is broken on the exterior with small holes along length also comes out of holes at intersection with item 292		
294	vertical fracture	7.3	7.33	vertical	south	tight with holes	slightly broken exterior		
295	vertical fracture	7.3	7.51	vertical	west	tight with holes	broken exterior and holes where it intersects the horizontal fracture		
296	horizontal fracture	-0.33	7.37	horizontal	full	tight with holes	holes where vertical fractures intersect		
297	vertical fracture	7.3	7.51	vertical	south east	tight with holes	material broken away in spots with broken exterior.		
298	horizontal fracture	-0.33	7.41	horizontal	full	tight	tight fracture with slightly visible dark staining.		
299	horizontal fracture	-0.33	7.47	horizontal	full	tight	slight texture change but tight. Holes where vertical fractures meet it		
300	horizontal fracture	-0.33	7.51	horizontal	full	tight	tight with a bit of dark staining. Holes along fracture very present on north side		
301	horizontal fracture	-0.33	7.55	horizontal	full	tight with large holes	can see small columnar crytals. Small holes on western side of borehole. Holes on south with dark staining on holes all along.		
302	horizontal fracture	-0.33	7.59	horizontal	full	holes	part of a crystal change and lots of holes along fracture and between item 301 and this depth. Can see water on borehole wall and in holes on eastern side.	CV - 13	
303	vertical fracture	7.59	7.83	vertical	south east	tight with holes	slightly broken exterior		
304	horizontal fracture	-0.33	7.69	horizontal	full	tight with holes	evident crystal change with small holes on south and indentation along fracture		
305	horizontal fracture	-0.33	7.74	horizontal	full	tight with large holes	tight fracture but visible dark staining.		
306	vertoca; fractire	7.77	7.88	vertical	west	tight	tight with slightly broken exterior		
307	horizontal fracture	-0.33	7.79	horizontal	full	tight	evident texture change with dark blocky yellow cyrstals		
308	vertical fracture	7.77	7.96	vertical	east	tight	slightly broken exterior		
309	horizontal fracture	-0.33	7.81	horizontal	full	tight	crystal change with columnar crystals shown		

Item #	Feature	Top of Feature (mbss)	Bottom of Feature (mbss)	Orientation	Location	Relative Openness	Description	Video Snapshot	Corresponding Test
310	horizontal fracture	-0.33	7.83	horizontal	full	holes	small and large holes all along fracture with columnar crystals evident and moisture in holes. North side tighter but can see crystal structure change		
311	horizontal fracture	-0.33	7.87	horizontal	full	tight	tight fracture with slightly visible dark staining. Crystal change		
312	horizontal fracture	-0.33	7.9	horizontal	full	tight	visible dark staining but tight		
313	horizontal fracture	-0.33	7.93	horizontal	full	tight	change in crystals with blocky yellow crystals above the fracture and tighter material below the fracture		
314	horizontal fracture	-0.33	7.96	horizontal	full	tight with holes	this fracture has very evident dark staining all along its length with several vertical fractures leaving it.		
315	vertical fracture	7.96	8.05	vertical	north	tight	tight fracture and small in length but very evident dark staining		
316	vertical fracture	7.96	8.05	vertical	west	tight	larger very evident dark staining.	CV - 14	
317	vertical fracture	7.96	8.05	vertical	south slighly west	tight	tight with again evident dark staining. Small in length		
318	vertical fracture	7.96	8.05	vertical	south	tight	very evident dark staining		
319	horizontal fracture	-0.33	8.01	horizontal	full	tight	tight fracture running through broken area. Area of blocky yellow crystals		180909-C-Vert-4 Ends
320	horizontal fracture	-0.33	8.03	horizontal	full	tight	tight fracture running through broken area. Area of blocky yellow crystals		180909-C-Vert-5 Begins
321	horizontal fracture	-0.33	8.05	horizontal	full	holes	this marks the bottom bondary of this very broken zone. There are many large holes along the south side towards the west and stop at the north with only small holes from the north along the east side. The vertical fractures along the west side have many holes and cracks along their intersection points and the material almost looks to crumble away or be crushed. Below this fracture the material is tight dull yellow matrix and the fractures all seem to end here.		
322	horizontal fracture	-0.33	8.09	horizontal	full	tight	tight fracture with indentation on south side		
323	horizontal fracture	-0.33	8.16	horizontal	full	tight with holes	hard to make out fracture but small holes on south and north and east sides. Little visible dark staining on north east side.		
324	horizontal fracture	-0.33	8.2	horizontal	full	large holes	on the west there is again an area of broken material with large holes along the north. Dark staiing on the north east but you can see into the fractures on the north with large pieces of material missing.		
325	horizontal fracture	-0.33	5.25	horizontal	full	large holes	part of a large broken zone starting at item 324. on the east there are some smaller holes		
326	horizontal fracture	-0.33	8.26	horizontal	full	tight with small holes	this marks the end of the broken material. Small holes .		
327	vertical fracture	8.26	8.35	vertical	south	tight	tight fracture with broken exterior starting out of itme 326		
328	horizontal fracture	-0.33	8.3	horizontal	full	holes	another area of crystal change and broken material. Holes on the western and northern wall. East has small holes as well.		
329	vertical fracture	8.26	8.35	vertical	north	tight	tight fracture with broken exterior and holes as it intersects item 328		
330	vertical fracture	8.26	8.35	vertical	west	tight with holes	some small holes along the fracture and holes where it intersects item 328		
331	horizontal fracture	-0.33	8.35	horizontal	full	tight	tight fracture indicates the end of the broken matieral and the end of the vertical fractures		
332	horizontal fracture	-0.33	8.42	horizontal	ful	holes	an area of crystal change with holes around the length of the fracture and broken material		
333	vertical fractture	8.35	8.42	vertical	north	tight	tight fracture		
334	vertical fracture	8.35	8.42	vertical	north east	tight	tight fracture intersecting fracture item 332.		
335	vertical fracture	8.42	8.49	vertical	south	tight	broken exterior		
336	vertical fracture	8.42	8.47	vertical	west	tight	tight fracture with broken exterior		
337	horizontal fracture	-0.33	8.49	horizontal	full	tight with holes	on the south and west side there are some small holes with dark staining on the north		
338	vertical fracture	8.49	8.92	vertical	north	tight	broken exterior with some small holes		
339	vertical fracture	8.49	8.61	vertical	east	tight	tight fracture with broken exterior		
340	horizontal fracture	-0.33	8.52	horizontal	full	tight	slightly visible dark staining and small holes on the south side		
341	vertical fracture	8.52	8.61	vertical	west	tight	tight fracture with slightly visible dark staining.		
342	horizontal fracture	-0.33	8.57	horiztonal	full	tight with holes	fracture has small holes along its length with small vertical fracture connecting it to the next lower fracture.		
343	vertical fracture	8.57	8.87	vertical	south	tight	tight small frature that connects to horizontal fratures.		
344	horizontal fracture	-0.33	8.61	horizontal	full	tight with holes	very small broken exterior with visible dark staining and small holes along its length		180909-C-Vert-6 Begins
345	horizontal fracture	-0.33	8.64	horizontal	full		small holes and partially open with slightly broken exterior		
346	vertical fracture	8.64	8.87	vertical	east	tight	tight fracture connecting two horizontal fractures		
347	horizontal fracture	8.64	8.87	vertical	west	tight	tight with small holes and slightly broken exterior		
348	horizontal fracture	-0.33	8.66	horizontal	full	tight	tight fracture with visible dark staining and slight broken exterior		
349	horizontal fracture	-0.33	8.69	horizontal	full	tight	only slightly visible dark staining. In some areas hard to see.		
350	horizontal fracture	-0.33	8.72	horizontal	full	holes	small holes along its legnth. As we go to the east the fracture is partially open and the dark staining is visible all the way to the south.		
351	horizontal fracture	-0.33	8.75	horizontal	full	tight	tight fracture running through some broken material		
352	horizontal fracture	-0.33	8.79	horizontal	full	tight	tight fracture through zone of crystal change. On east and north there are small and large holes		
353	horizontal fracture	-0.33	8.85	horizontal	full	tight	tight fracture with dark staining and partially open from the east to the north		
354	horizontal fracture	-0.33	8.87	horizontal	full	holes	holes along the fracture where the fracture is open. On the south you can see the columnar crystals in an open hole. Tighter material below this fractue		

Item #	Feature	Top of Feature (mbss)	Bottom of Feature (mbss)	Orientation	Location	Relative Openness	Description	Video Snapshot	Corresponding Test
355	horizontal fracture	-0.33	8.94	horizontal	full	tight	tight fracture with slight crystal change		
356	horizontal fracture	-0.33	8.97	horizontal	full	tight	tight fracture with larger holes on the west. Smaller hoes on the north and east with crystals evident in broken sections		
357	horizontal fracture	-0.33	9	horizontal	full	tight	broken away material with columnar crystals in broken areas on west and towards north		
358	horizontal fracture	-0.33	9.03	horizontal	full	tight	tight fracture with visible dark staining		
359	horizontal fracture	-0.33	9.07	horizontal	full	tight with holes	broken material along this zone with yellow blocky material above and large broken crystals. Boundary to tighter dull yellow matrix below.		
360	horizontal fracture	-0.33	9.1	horizontal	full	tight	tight fracture partially open only in few locations with dark staining		
361	vertical fracture	9.1	9.21	vertical	east	tight	tight fracture with broken exterior and small open holes		
362	horizontal fracture	-0.33	9.17	horizontal	full	tight	crystal structure change to yellow blocky crystals below it		
363	horizontal fracture	-0.33	9.21	horizontal	full	tight with holes	boundary of yellow blocky material with open holes on south and dark staining on the east.		
364	horizontal fracture	-0.33	9.26	horizontal	full	tight with holes	tight fracture with only few small holes		
365	horizontal fracture	-0.33	9.29	horizontal	full	tight	tight fracture with a bit of crystal change and small holes just below it		
366	horizontal fracture	-0.33	9.35	horizontal	full	tight	tight fracture is boundary to crystals above and slightly visible dark staining		
367	horizontal fracture	-0.33	9.38	horizontal	full	tight	tight fractures with yellow blocky crystals below it with slightly visible dark staining and not be able to see it in some areas		180909-C-Vert-5 Ends
368	horizontal fracture	9.38	9.41	vertical	east	tight	tight fracture with broken exterior		
369	horizontal fracture	-0.33	9.41	horizontal	full	tight	tight fracture acts as boundary to yellow blocky crystals above it		
370	horizontal fracture	-0.33	9.44	horizontal	full	tight	small microfractures connect some of these close horizontal fractures. Dark staining around the east and north. Closed on the west with only small slits toward the south. Blocky crstyal structure above it		
371	horizontal fracture	-0.33	9.47	horizontal	full		beginning of yellow blocky crystal structure		
372	vertical fracture	9.47	9.65	vertical	north	tight	tight fracture with broken exterior		
373	vertical fracture	9.47	9.62	vertical	west	tight	tight fracture with broken exterior		
374	horizontal fracture	-0.33	9.62	horizontal	full	tight	not really an evident fracture but an area of crystal change or density		
375	horizontal fracture	-0.33	9.67	horizontal	full	tight	area of crystal change from blocky yellow crystals to slightly tighter material and ending the fracture in the north		
376	horizontal fracture	-0.33	9.7	horizontal	full	tight	tight fracture indicated by indentation and slighlty visible dark staining. Dark blocky yellow crystals below it		
377	vertical fracture	9.7	9.97	vertical	north	tight with holes	tight fracture with broken exterior and holes		
378	vertical fracture	9.68	9.85	vertical	south west inclined towards south	tight	tight with broken exterior		
379	horizontal fracture	-0.33	9.77	horizontal	full	tight	fracture only visible by linearness of broken material and pock marks		
380	horizontal fracture	-0.33	9.85	horizontal	full	tight	boundary or yellow blocky material above and tight dull yellow matrix below		
381	vertical fracture	9.85	9.97	vertical	east	tight	tight fracture		
382	vertical fracture	9.85	9.97	vertical	west	tight	tight fracture with broken exterior		
383	horizontal fracture	-0.33	9.91	horizontal	full	small holes	tight fracture with small holes and broken away material		
384	horizontal fracture	-0.33	9.97	horizontal			enter a zone of broken material at this depth with many vertical fractures coming from this fracture. highly visible staining on fracture face.		180909-C-Vert-6 Ends
385	vertical fractue	9.97	10.02	vertical	north	partially open	seems to be part of item 377 but at this depth it seems to have split in two just above. At this depth it becomes open		
386	vertical fracture	9.97	10.05	vertical	north	partially open	offshoot of item377 and is very open at this depth. There is black staining on the face and alos leaving the fracture is black staining which may have been carried by water		
387	vertical fracture	9.97	10.05	vertical	south	partially open	this fracture comes out of item 384 and is partially open with black staining or shadowing along the face	CV - 16	
388	vertical fracture	9.97	10.05	vertical	south west	partially open	see comments from item 387		
389	horizontal fracture	-0.33	10.02	horizontal	full	partially open	this fracture is partially open and has broken yellow blocky crystals above it with tighter dull matrix below it		
390	vertical fracture	9.97	10.23	vertical	east	tight	broken exterior		
391	vertical fracture	9.97	10.05	vertical	north east	tight	tight fracture with broken exterior		
392	vertical fracture	10.05	10.23	vertical	north	tight	items 386 and 387 connect at this depth and form a single vertical fracture that starts to incline toward the south		
393	horizontal fracture	-0.33	10.06	horizontal	full	tight	crystal structure change with visisble dark staining on the west		
394	horizontal fracture	-0.33	10.09	horizontal	full	tight	tight fracture with some crystal change and dark staining in some locations		
395	horizontal fracture	-0.33	10.19	horizontal	full	tight	tight fracture with slight indentation and texture change		
396	horizontal fracture	-0.33	10.23	horizontal	full	tight	south side you can see evident changes in crystal structure. Not as evident on east and north side. Some dark blocky yellow crystals above with duller yellow crystals below		
397	horizontal fracture	-0.33	10.29	horizontal	full	tight	dark staining and tight		
398	horizontal fracture	-0.33	10.3	horizontal	full	tight	slightly visible dark staining but visible all around the hole		
399	horizontal fracture	-0.33	10.33	horizontal	full	tight	tight fracture with slightly visible dark staining		
400	vertical fracture	10.23	10.39	vertical	north	tight	part of item 392 but not as large or open at this depth		

Item #	Feature	Top of Feature (mbss)	Bottom of Feature (mbss)	Orientation	Location	Relative Openness	Description	Video Snapshot	Corresponding Test
401	horizontal fracture	-0.33	10.39	horizontal	full	tight	texture change with yellow blocky crystals above and tighter dull yellow material below. Dark staining on the eastern side.		
402	vertical fracture	10.36	10.41	vertical	south	tight	tight fracture with slightly broken exterior		
403	horizontal fracture	-0.33	10.53	horizontal	full	tight	tight fracture with visible staining with a large deep hole on the north east side		
404	horizontal fracture	-0.33	10.55	horizontal	full	tight	tight fracture with visible staining. Proximity to item 403 may be the reason for the broken area on the north east side. Blocky yellow crystal below		
405	horizontal fracture	-0.33	10.59	horizontal	full	tight	tight fracture with slightly visible dark staining		
405	vertical fracture	10.59	10.62	vertical	west	tight	very small fracture with evident dark staining meeting a dark stained horizontal fracture	CV - 17	
406	vertical fracture	10.59	10.97	vertical	north	tight	tight with broken exterior		
407	horizontal fracture	-0.33	10.62	horizontal	full	tight	tight fracture runs through area of broken material. Dark staining		
408	horizontal fracture	-0.33	10.64	horizontal	full	partially open	very evident dark staining		
409	horizontal fracture	-0.33	10.66	horizontal	full	partially open	very evident dark staining but not quite as evident on the west		
410	vertical fractures	10.62	10.97	vertical	east	tight	tight fractures with very evident dark staining		
411	vertical fractue	10.62	10.97	vertical	west	tight	tight with broken exterior		
412	horizontal fracture	-0.33	10.71	horizontal	full	partially open	partially open fracture with very evident dark staining. Hole where the vertical fracture on the east intersects.		
413	horizontal fracture	-0.33	10.74	horizontal	full	tight with holes	texture change to blocky yellow crystals and holes at the intersection of vertical fractures.		
414	horizontal fracture	-0.33	10.75	horizontal	full	tight	almost overlaps item 414 with dark staining along its length	CV - 18	
415	horizontal fracture	-0.33	10.77	horizontal	full	tight	texture change and slightly visible dark staining. Change of crystals with dark blocky yellow crystals above it		
416	horizontal fracture	-0.33	10.86	horizontal	full	tight	tight fracture with evident dark staining		
417	horizontal fracture	-0.33	10.9	horizontal	full	tight	crystal structure change		
418	horizontal fracture	-0.33	10.92	horizontal	full	tight	tight fracture with dark staining.		
418	horizontal fracture	-0.33	10.96	horizontal	full	tight	tight fracture with evident dark staining. Texutre change with blocky crystals above it.		

APPENDIX D
DIGITAL VIDEO SNAPSHOTS

Note: Borehole image names correspond to Video Snapshot identifier in Appendix C.

BA – 1

BA – 2

BA – 3

BA – 4

BA – 5

BA – 6

BA – 7

BA – 8

BA – 9

BA – 10

BA – 11

BA – 12

BA – 13

BA – 14

BA – 15

BA – 16

BA – 17

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BA – 32

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BA – 34

BA – 35

BA – 36

BA – 37

BA – 38

BA – 39

BA – 40

CV – 1

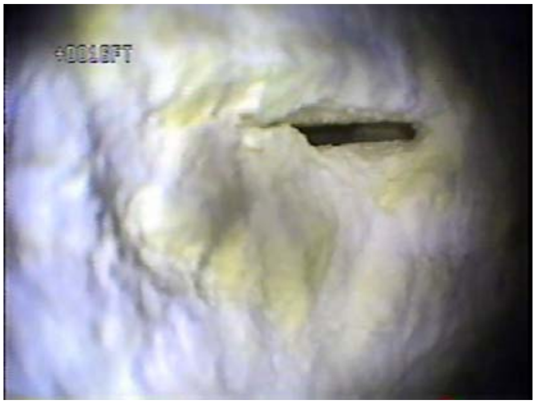
CV – 2

CV – 3

CV – 4

CV – 5

CV – 6



CV – 7

CV – 8

CV – 9

CV – 10

CV – 11

CV – 12

CV – 13

CV – 14

CV – 16

CV – 17

CV - 18

APPENDIX E
SUMMARY OF MEASURED AND SIMULATED DRAWDOWN DATA

Packer Test:	**140909-A-VERT-1**	**FLOW RATE 1**
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.25E-02	1.89E-02
1.46E-02	2.21E-02
1.82E-02	2.75E-02
1.46E-02	2.21E-02
1.32E-02	2.00E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.73E-05	1.20	999.32

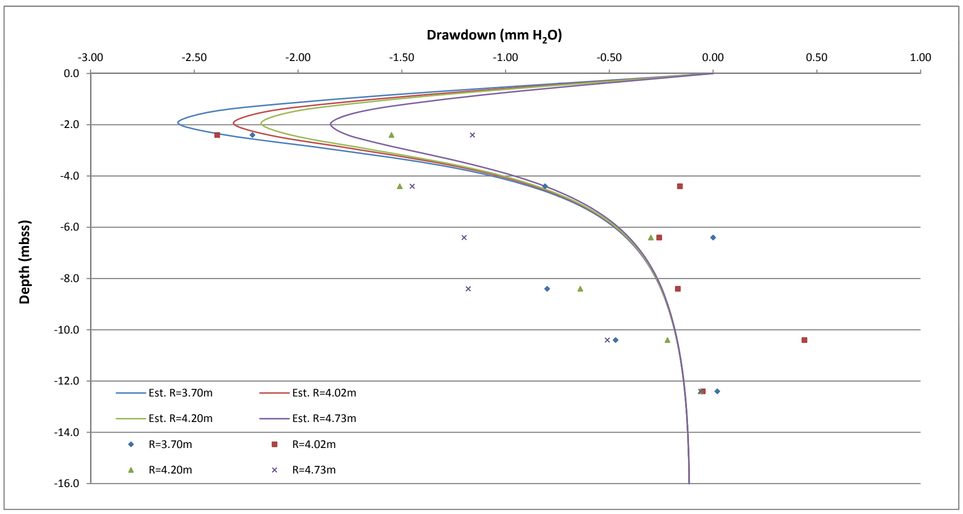
K_{gx} (m/s)	A_{gr} (-)	**KD** (-)
2.50E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m ($mm\ H_2O$)	**CMT 130** R=4.2m ($mm\ H_2O$)	**CMT 129** R=4.7m ($mm\ H_2O$)	**CMT 128** R=3.7m ($mm\ H_2O$)
-2.4	-2.39	-1.55	-1.16	-2.22
-4.4	-0.16	-1.51	-1.45	-0.81
-6.4	-0.26	-0.3	-1.2	0
-8.4	-0.17	-0.64	-1.18	-0.8
-10.4	0.44	-0.22	-0.51	-0.47
-12.4	-0.05	-0.06	-0.06	0.02
-14.4	0	0	0	-0.1

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH ($mm\ H_2O$)	**CMT 130** R=4.2m TH ($mm\ H_2O$)	**CMT 129** R=4.7m TH ($mm\ H_2O$)	**CMT 128** R=3.7m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-2.4	-2.14	-2.04	-1.76	-2.35	0.68
-4.4	-0.86	-0.85	-0.81	-0.88	1.34
-6.4	-0.42	-0.41	-0.40	-0.42	0.84
-8.4	-0.25	-0.25	-0.25	-0.25	1.33
-10.4	-0.17	-0.17	-0.17	-0.17	0.58
-12.4	-0.14	-0.14	-0.14	-0.14	0.04
-14.4	-0.12	-0.12	-0.12	-0.12	0.04
				Total	4.86



NOTES:

- i.e. -R=3.7m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	140909-A-VERT-1	FLOW RATE 2
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^{o}C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.25E-02	1.89E-02
1.46E-02	2.21E-02
1.82E-02	2.75E-02
1.46E-02	2.21E-02
1.32E-02	2.00E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.73E-05	1.20	999.32

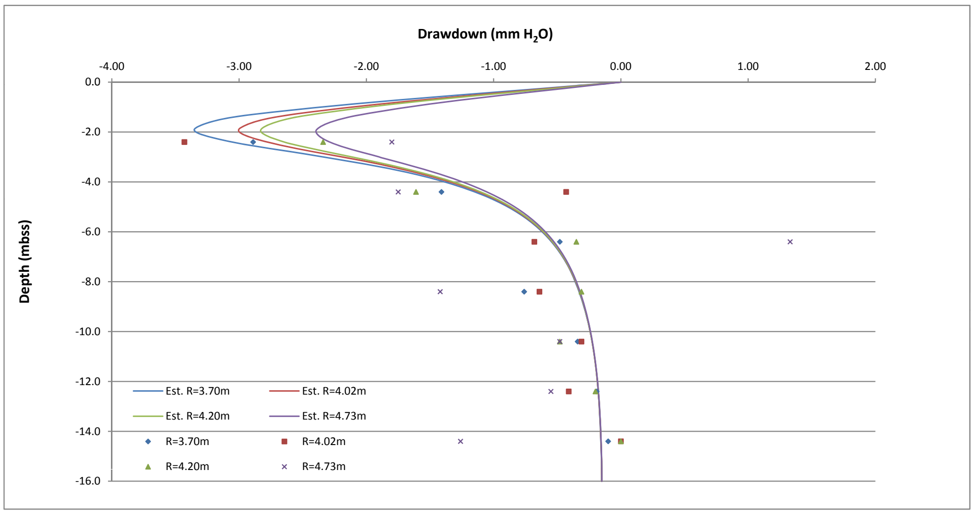
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.25E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m ($mm H_2O$)	**CMT 130** R=4.2m ($mm H_2O$)	**CMT 129** R=4.7m ($mm H_2O$)	**CMT 128** R=3.7m ($mm H_2O$)
-2.4	-3.43	-2.34	-1.8	-2.89
-4.4	-0.43	-1.61	-1.75	-1.41
-6.4	-0.68	-0.35	1.33	-0.48
-8.4	-0.64	-0.31	-1.42	-0.76
-10.4	-0.31	-0.48	-0.48	-0.34
-12.4	-0.41	-0.2	-0.55	-0.19
-14.4	0	0	-1.26	-0.1

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH ($mm H_2O$)	**CMT 130** R=4.2m TH ($mm H_2O$)	**CMT 129** R=4.7m TH ($mm H_2O$)	**CMT 128** R=3.7m TH ($mm H_2O$)	**SLS** ($mm^2 H_2O$)
-2.4	-2.78	-2.65	-2.29	-3.06	0.78
-4.4	-1.12	-1.10	-1.05	-1.15	1.29
-6.4	-0.54	-0.54	-0.53	-0.55	3.50
-8.4	-0.32	-0.32	-0.32	-0.33	1.50
-10.4	-0.23	-0.23	-0.22	-0.23	0.15
-12.4	-0.18	-0.18	-0.18	-0.18	0.19
-14.4	-0.16	-0.16	-0.15	-0.16	1.27
				Total	8.68



NOTES:

- i.e. -R=3.7m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**140909-A-VERT-1**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.25E-02	1.89E-02
1.46E-02	2.21E-02
1.82E-02	2.75E-02
1.46E-02	2.21E-02
1.32E-02	2.00E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.73E-05	1.20	999.32

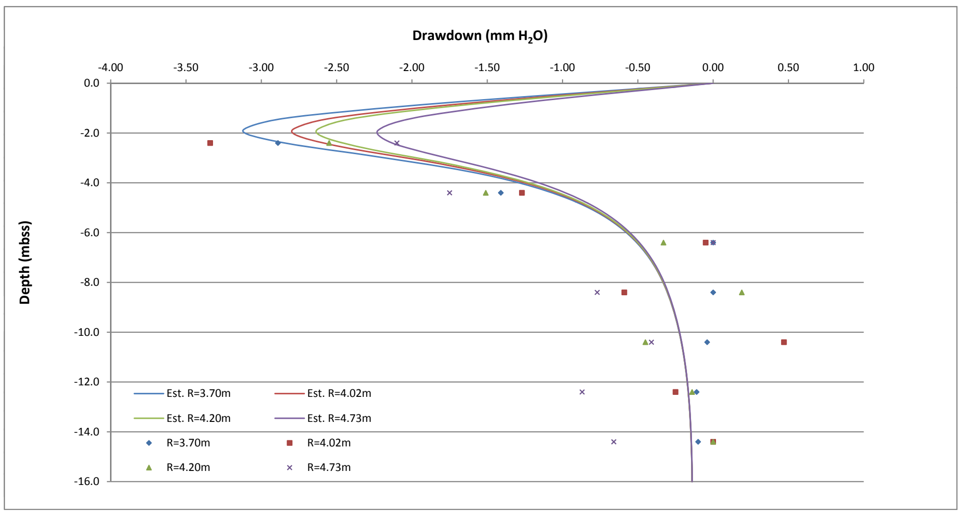
K_{gx} (m/s)	A_{gr} (-)	KD (-)
3.00E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m ($mm\ H_2O$)	**CMT 130** R=4.2m ($mm\ H_2O$)	**CMT 129** R=4.7m ($mm\ H_2O$)	**CMT 128** R=3.7m ($mm\ H_2O$)
-2.4	-3.34	-2.55	-2.1	-2.89
-4.4	-1.27	-1.51	-1.75	-1.41
-6.4	-0.05	-0.33	0	0
-8.4	-0.59	0.19	-0.77	0
-10.4	0.47	-0.45	-0.41	-0.04
-12.4	-0.25	-0.14	-0.87	-0.11
-14.4	0	0	-0.66	-0.1

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH ($mm\ H_2O$)	**CMT 130** R=4.2m TH ($mm\ H_2O$)	**CMT 129** R=4.7m TH ($mm\ H_2O$)	**CMT 128** R=3.7m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-2.4	-2.59	-2.46	-2.13	-2.85	0.57
-4.4	-1.04	-1.03	-0.98	-1.07	0.99
-6.4	-0.50	-0.50	-0.49	-0.51	0.73
-8.4	-0.30	-0.30	-0.30	-0.30	0.64
-10.4	-0.21	-0.21	-0.21	-0.21	0.59
-12.4	-0.17	-0.17	-0.16	-0.17	0.51
-14.4	-0.14	-0.14	-0.14	-0.15	0.31
				Total	4.34



NOTES:
- i.e. -R=3.7m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Syncrude

Packer Test: **140909-A-VERT-1** **FLOW RATE 4**

Client: Syncrude Canada Ltd.

Test Date	14-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.25E-02	1.89E-02
1.46E-02	2.21E-02
1.82E-02	2.75E-02
1.46E-02	2.21E-02
1.32E-02	2.00E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.73E-05	1.20	999.32

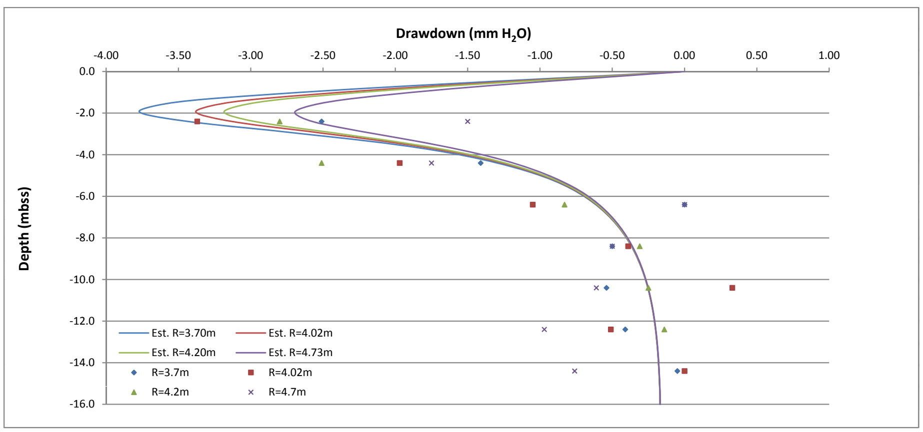
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.00E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth	**CMT 131**	**CMT 130**	**CMT 129**	**CMT 128**
	R=4.02m	R=4.2m	R=4.7m	R=3.7m
(mbss)	(mm H_2O)	(mm H_2O)	(mm H_2O)	(mm H_2O)
-2.4	-3.37	-2.8	-1.5	-2.51
-4.4	-1.97	-2.51	-1.75	-1.41
-6.4	-1.05	-0.83	0	0
-8.4	-0.39	-0.31	-0.5	-0.5
-10.4	0.33	-0.25	-0.61	-0.54
-12.4	-0.51	-0.14	-0.97	-0.41
-14.4	0	0	-0.76	-0.05

Simulated Drawdown at Monitoring Locations

Port Depth	**CMT 131**	**CMT 130**	**CMT 129**	**CMT 128**	**SLS**
	R=4.02m	R=4.2m	R=4.7m	R=3.7m	
(mbss)	TH (mm H_2O)	TH (mm H_2O)	TH (mm H_2O)	TH (mm H_2O)	(mm^2 H_2O)
-2.4	-3.13	-2.98	-2.58	-3.44	2.11
-4.4	-1.26	-1.24	-1.19	-1.29	2.45
-6.4	-0.61	-0.60	-0.59	-0.61	0.97
-8.4	-0.37	-0.36	-0.36	-0.37	0.04
-10.4	-0.25	-0.25	-0.25	-0.26	0.55
-12.4	-0.20	-0.20	-0.20	-0.20	0.74
-14.4	-0.17	-0.17	-0.17	-0.18	0.42
				Total	7.28



NOTES:

- i.e. -R=3.7m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

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Packer Test:	140909-A-VERT-1	FLOW RATE 5
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	Flux (m/s)
1.25E-02	1.89E-02
1.46E-02	2.21E-02
1.82E-02	2.75E-02
1.46E-02	2.21E-02
1.32E-02	2.00E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.73E-05	1.20	999.32

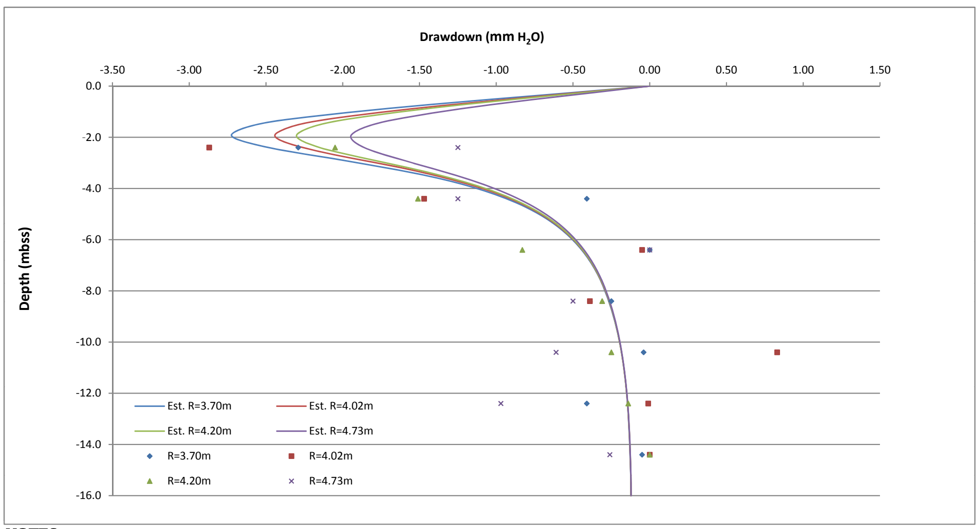
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.50E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	CMT 131 R=4.02m ($mm\ H_2O$)	CMT 130 R=4.2m ($mm\ H_2O$)	CMT 129 R=4.7m ($mm\ H_2O$)	CMT 128 R=3.7m ($mm\ H_2O$)
-2.4	-2.87	-2.05	-1.25	-2.29
-4.4	-1.47	-1.51	-1.25	-0.41
-6.4	-0.05	-0.83	0	0
-8.4	-0.39	-0.31	-0.5	-0.25
-10.4	0.83	-0.25	-0.61	-0.04
-12.4	-0.01	-0.14	-0.97	-0.41
-14.4	0	0	-0.26	-0.05

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	CMT 131 R=4.02m TH ($mm\ H_2O$)	CMT 130 R=4.2m TH ($mm\ H_2O$)	CMT 129 R=4.7m TH ($mm\ H_2O$)	CMT 128 R=3.7m TH ($mm\ H_2O$)	SLS ($mm^2\ H_2O$)
-2.4	-2.26	-2.15	-1.86	-2.48	0.79
-4.4	-0.91	-0.90	-0.86	-0.93	1.12
-6.4	-0.44	-0.44	-0.43	-0.44	0.69
-8.4	-0.26	-0.26	-0.26	-0.27	0.08
-10.4	-0.18	-0.18	-0.18	-0.18	1.24
-12.4	-0.14	-0.14	-0.14	-0.14	0.77
-14.4	-0.13	-0.13	-0.13	-0.13	0.06
				Total	4.73



NOTES:

- i.e. -R=3.7m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**140909-A-VERT-2**	**FLOW RATE 1**
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^oC)	9.0
Ambient Barometric Pressure (kPa)	100.3
Center of Test Interval (mbss)	3.11
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.32E-02	2.00E-02
1.70E-02	2.57E-02
1.32E-02	2.00E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.32

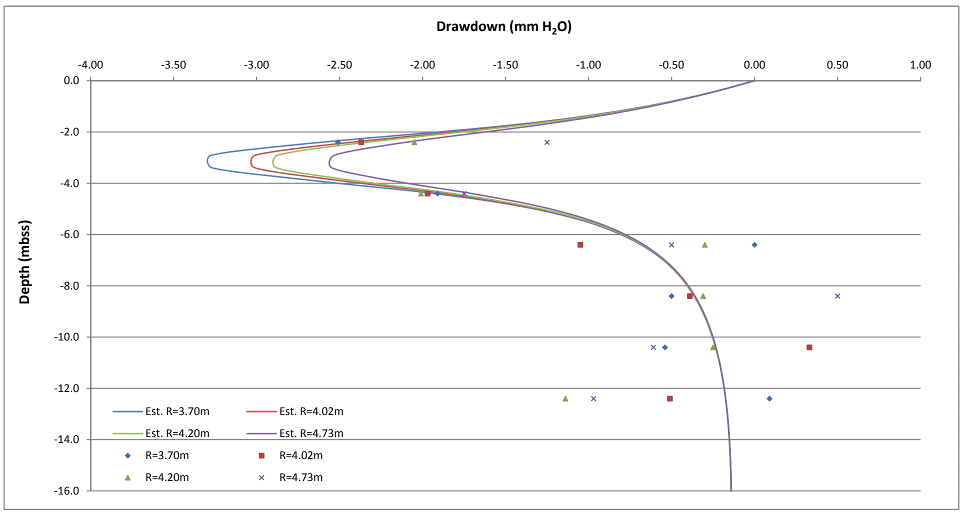
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.50E-04	0.05	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m ($mm\ H_2O$)	**CMT 130** R=4.2m ($mm\ H_2O$)	**CMT 129** R=4.7m ($mm\ H_2O$)	**CMT 128** R=3.7m ($mm\ H_2O$)
-2.4	-2.37	-2.05	-1.25	-2.51
-4.4	-1.97	-2.01	-1.75	-1.91
-6.4	-1.05	-0.3	-0.5	0
-8.4	-0.39	-0.31	0.5	-0.5
-10.4	0.33	-0.25	-0.61	-0.54
-12.4	-0.51	-1.14	-0.97	0.09
-14.4	0	0	-0.76	-0.3

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH ($mm\ H_2O$)	**CMT 130** R=4.2m TH ($mm\ H_2O$)	**CMT 129** R=4.7m TH ($mm\ H_2O$)	**CMT 128** R=3.7m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-2.4	-2.43	-2.34	-2.10	-2.61	0.82
-4.4	-1.86	-1.82	-1.70	-1.93	0.05
-6.4	-0.68	-0.68	-0.67	-0.68	0.77
-8.4	-0.36	-0.36	-0.36	-0.36	0.76
-10.4	-0.23	-0.23	-0.23	-0.24	0.55
-12.4	-0.17	-0.17	-0.17	-0.18	1.75
-14.4	-0.15	-0.15	-0.15	-0.15	0.44
				Total	5.16



NOTES:

- i.e. -R=3.7m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**140909-A-VERT-2**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^oC)	9.0
Ambient Barometric Pressure (kPa)	100.3
Center of Test Interval (mbss)	3.11
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.32E-02	2.00E-02
1.70E-02	2.57E-02
1.32E-02	2.00E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.32

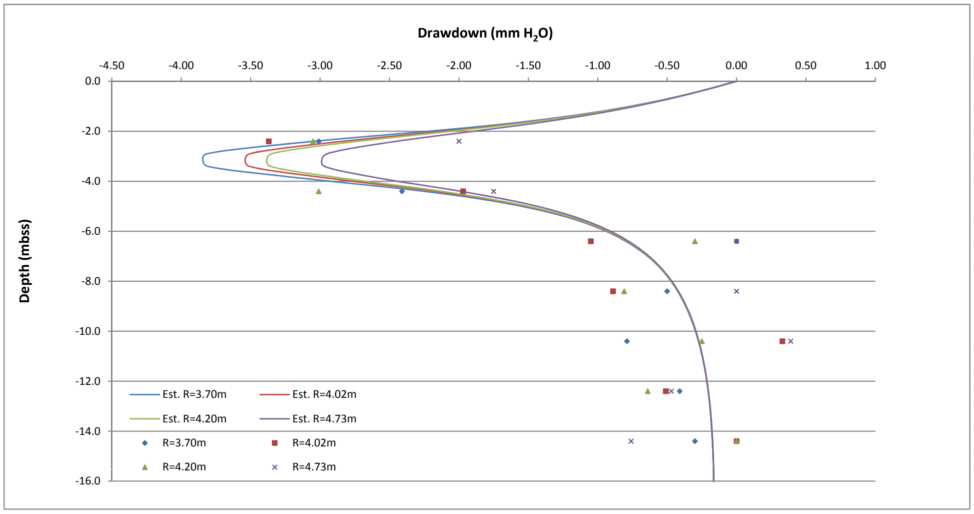
K_{gx} (m/s)	A_{gr} (-)	**KD** (-)
3.00E-04	0.05	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m ($mm\ H_2O$)	**CMT 130** R=4.2m ($mm\ H_2O$)	**CMT 129** R=4.7m ($mm\ H_2O$)	**CMT 128** R=3.7m ($mm\ H_2O$)
-2.4	-3.37	-3.05	-2	-3.01
-4.4	-1.97	-3.01	-1.75	-2.41
-6.4	-1.05	-0.3	0	0
-8.4	-0.89	-0.81	0	-0.5
-10.4	0.33	-0.25	0.39	-0.79
-12.4	-0.51	-0.64	-0.47	-0.41
-14.4	0	0	-0.76	-0.3

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH ($mm\ H_2O$)	**CMT 130** R=4.2m TH ($mm\ H_2O$)	**CMT 129** R=4.7m TH ($mm\ H_2O$)	**CMT 128** R=3.7m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-2.4	-2.84	-2.73	-2.45	-3.04	0.59
-4.4	-2.16	-2.12	-1.99	-2.25	0.92
-6.4	-0.79	-0.79	-0.78	-0.80	1.54
-8.4	-0.42	-0.42	-0.42	-0.42	0.55
-10.4	-0.27	-0.27	-0.27	-0.27	1.07
-12.4	-0.20	-0.20	-0.20	-0.20	0.40
-14.4	-0.17	-0.17	-0.17	-0.17	0.42
				Total	5.49



NOTES:

- i.e. -R=3.7m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**140909-A-VERT-2**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^oC)	9.0
Ambient Barometric Pressure (kPa)	100.3
Center of Test Interval (mbss)	3.11
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.32E-02	2.00E-02
1.70E-02	2.57E-02
1.32E-02	2.00E-02
9.44E-03	1.43E-02

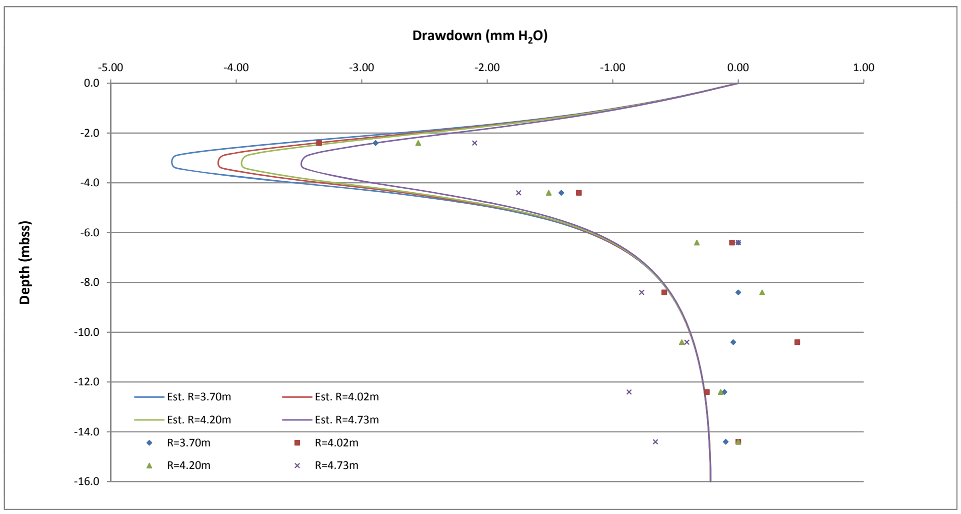
μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.32
K_{gx} (m/s)	**A_{gr}** (-)	**KD** (-)
3.00E-04	0.06	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m ($mm\ H_2O$)	**CMT 130** R=4.2m ($mm\ H_2O$)	**CMT 129** R=4.7m ($mm\ H_2O$)	**CMT 128** R=3.7m ($mm\ H_2O$)
-2.4	-3.34	-2.55	-2.1	-2.89
-4.4	-1.27	-1.51	-1.75	-1.41
-6.4	-0.05	-0.33	0	0
-8.4	-0.59	0.19	-0.77	0
-10.4	0.47	-0.45	-0.41	-0.04
-12.4	-0.25	-0.14	-0.87	-0.11
-14.4	0	0	-0.66	-0.1

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH ($mm\ H_2O$)	**CMT 130** R=4.2m TH ($mm\ H_2O$)	**CMT 129** R=4.7m TH ($mm\ H_2O$)	**CMT 128** R=3.7m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-2.4	-3.37	-3.24	-2.89	-3.62	1.91
-4.4	-2.66	-2.60	-2.42	-2.77	0.77
-6.4	-1.01	-1.01	-0.99	-1.02	1.62
-8.4	-0.55	-0.55	-0.54	-0.55	0.60
-10.4	-0.36	-0.36	-0.36	-0.36	1.01
-12.4	-0.27	-0.27	-0.27	-0.27	0.71
-14.4	-0.23	-0.23	-0.23	-0.23	1.27
				Total	7.88



NOTES:
- i.e. -R=3.7m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	140909-A-VERT-2	FLOW RATE 4
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^oC)	9.0
Ambient Barometric Pressure (kPa)	100.3
Center of Test Interval (mbss)	3.11
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	Flux (m/s)
9.44E-03	1.43E-02
1.32E-02	2.00E-02
1.70E-02	2.57E-02
1.32E-02	2.00E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.32

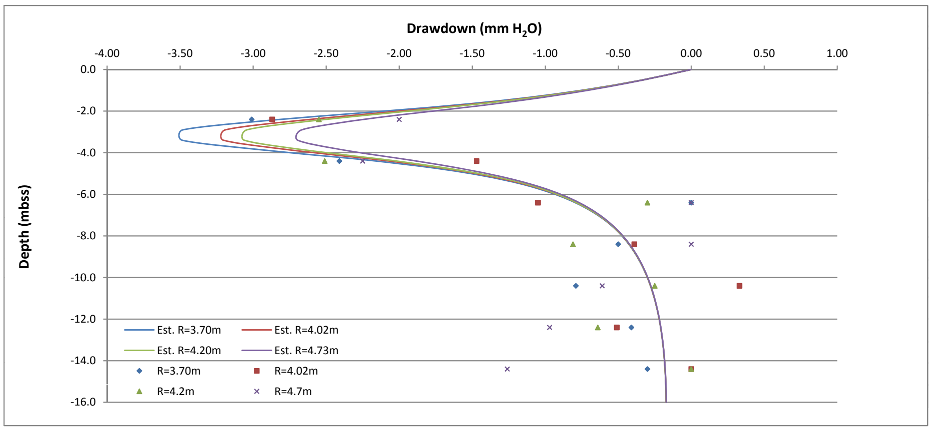
K_{gx} (m/s)	A_{gr} (-)	KD (-)
3.00E-04	0.06	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	CMT 131 R=4.02m (mm H_2O)	CMT 130 R=4.2m (mm H_2O)	CMT 129 R=4.7m (mm H_2O)	CMT 128 R=3.7m (mm H_2O)
-2.4	-2.87	-2.55	-2	-3.01
-4.4	-1.47	-2.51	-2.25	-2.41
-6.4	-1.05	-0.3	0	0
-8.4	-0.39	-0.81	0	-0.5
-10.4	0.33	-0.25	-0.61	-0.79
-12.4	-0.51	-0.64	-0.97	-0.41
-14.4	0	0	-1.26	-0.3

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	CMT 131 R=4.02m TH (mm H_2O)	CMT 130 R=4.2m TH (mm H_2O)	CMT 129 R=4.7m TH (mm H_2O)	CMT 128 R=3.7m TH (mm H_2O)	SLS (mm^2 H_2O)
-2.4	-2.62	-2.52	-2.25	-2.82	0.16
-4.4	-2.07	-2.02	-1.88	-2.16	0.80
-6.4	-0.79	-0.78	-0.77	-0.80	1.53
-8.4	-0.43	-0.42	-0.42	-0.43	0.33
-10.4	-0.28	-0.28	-0.28	-0.28	0.74
-12.4	-0.21	-0.21	-0.21	-0.21	0.89
-14.4	-0.18	-0.18	-0.18	-0.18	1.25
				Total	5.70



NOTES:
- i.e. -R=3.7m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

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Packer Test:	**140909-A-VERT-2**	**FLOW RATE 5**
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^oC)	9.0
Ambient Barometric Pressure (kPa)	100.3
Center of Test Interval (mbss)	3.11
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.32E-02	2.00E-02
1.70E-02	2.57E-02
1.32E-02	2.00E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.32

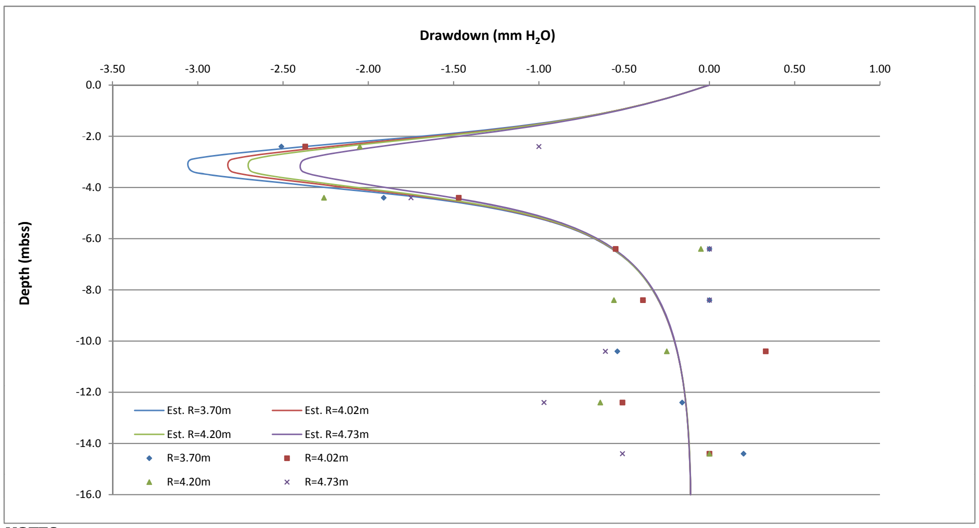
K_{gx} (m/s)	A_{gr} (-)	KD (-)
3.00E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m ($mm\ H_2O$)	**CMT 130** R=4.2m ($mm\ H_2O$)	**CMT 129** R=4.7m ($mm\ H_2O$)	**CMT 128** R=3.7m ($mm\ H_2O$)
-2.4	-2.37	-2.05	-1	-2.51
-4.4	-1.47	-2.26	-1.75	-1.91
-6.4	-0.55	-0.05	0	0
-8.4	-0.39	-0.56	0	0
-10.4	0.33	-0.25	-0.61	-0.54
-12.4	-0.51	-0.64	-0.97	-0.16
-14.4	0	0	-0.51	0.2

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH ($mm\ H_2O$)	**CMT 130** R=4.2m TH ($mm\ H_2O$)	**CMT 129** R=4.7m TH ($mm\ H_2O$)	**CMT 128** R=3.7m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-2.4	-2.22	-2.15	-1.94	-2.37	0.93
-4.4	-1.62	-1.59	-1.51	-1.68	0.58
-6.4	-0.57	-0.57	-0.56	-0.57	0.90
-8.4	-0.30	-0.30	-0.30	-0.30	0.25
-10.4	-0.19	-0.19	-0.19	-0.19	0.57
-12.4	-0.14	-0.14	-0.14	-0.14	1.08
-14.4	-0.12	-0.12	-0.12	-0.12	0.28
				Total	4.60



NOTES:

- i.e. -R=3.7m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**140909-A-VERT-3**	**FLOW RATE 1**
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^oC)	7.6
Ambient Barometric Pressure (kPa)	100.3
Center of Test Interval (mbss)	4.49
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.32E-02	2.00E-02
1.75E-02	2.64E-02
1.32E-02	2.00E-02
9.20E-03	1.39E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	1000.00

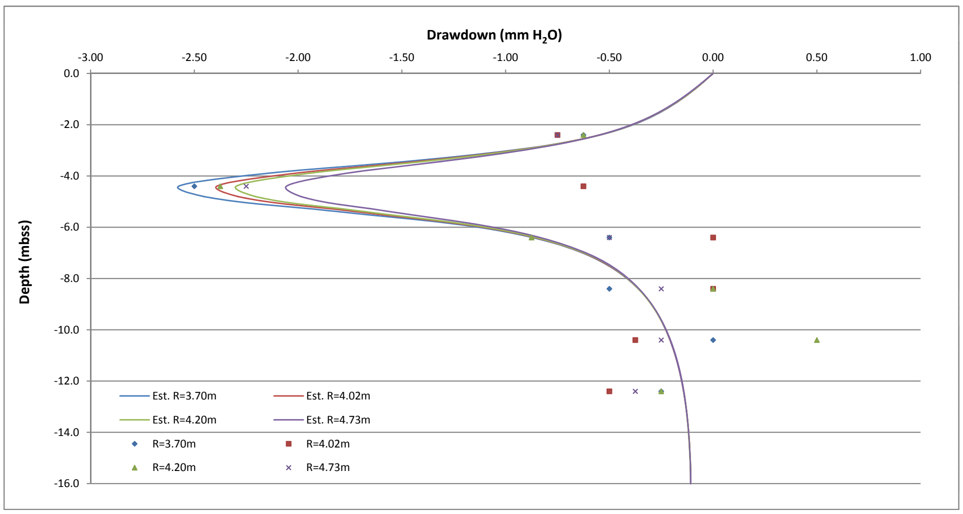
K_{gx} (m/s)	A_{gr} (-)	**KD** (-)
4.50E-04	0.03	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m (mm H_2O)	**CMT 130** R=4.2m (mm H_2O)	**CMT 129** R=4.7m (mm H_2O)	**CMT 128** R=3.7m (mm H_2O)
-2.4	-0.75	-0.625	-0.75	-0.625
-4.4	-0.625	-2.375	-2.25	-2.5
-6.4	0	-0.875	-0.5	-0.5
-8.4	0	0	-0.25	-0.5
-10.4	-0.375	0.5	-0.25	0
-12.4	-0.5	-0.25	-0.375	-0.25
-14.4	-0.125	-0.125	0	0.375

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH (mm H_2O)	**CMT 130** R=4.2m TH (mm H_2O)	**CMT 129** R=4.7m TH (mm H_2O)	**CMT 128** R=3.7m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-2.4	-0.55	-0.55	-0.55	-0.55	0.09
-4.4	-2.39	-2.30	-2.06	-2.58	3.17
-6.4	-0.86	-0.85	-0.83	-0.87	0.99
-8.4	-0.36	-0.36	-0.36	-0.36	0.29
-10.4	-0.21	-0.21	-0.21	-0.21	0.57
-12.4	-0.14	-0.14	-0.14	-0.14	0.21
-14.4	-0.11	-0.11	-0.11	-0.11	0.25
				Total	5.57



NOTES:
- i.e. -R=3.7m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**140909-A-VERT-3**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^oC)	7.6
Ambient Barometric Pressure (kPa)	100.3
Center of Test Interval (mbss)	4.49
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.32E-02	2.00E-02
1.75E-02	2.64E-02
1.32E-02	2.00E-02
9.20E-03	1.39E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	1000.00

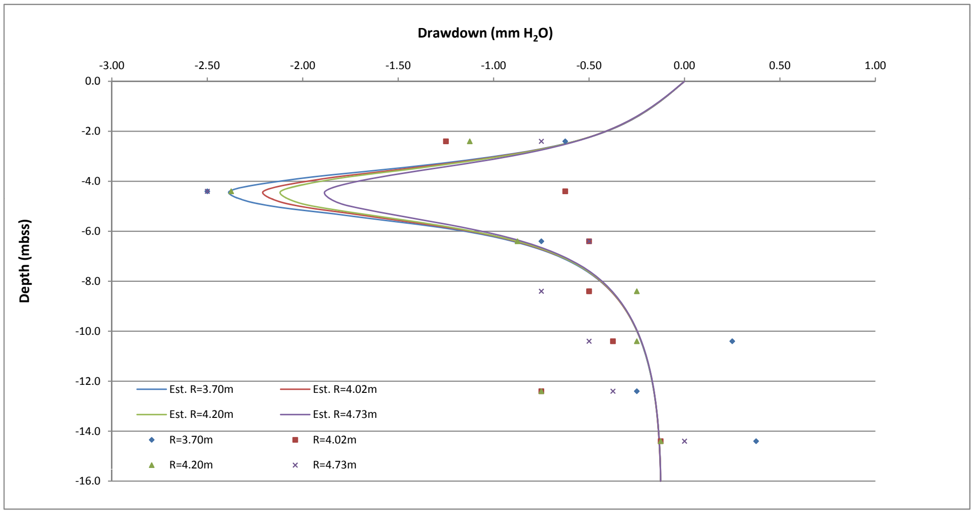
K_{gx} (m/s)	A_{gr} (-)	KD (-)
6.00E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m ($mm H_2O$)	**CMT 130** R=4.2m ($mm H_2O$)	**CMT 129** R=4.7m ($mm H_2O$)	**CMT 128** R=3.7m ($mm H_2O$)
-2.4	-1.25	-1.125	-0.75	-0.625
-4.4	-0.625	-2.375	-2.5	-2.5
-6.4	-0.5	-0.875	-0.5	-0.75
-8.4	-0.5	-0.25	-0.75	-0.5
-10.4	-0.375	-0.25	-0.5	0.25
-12.4	-0.75	-0.75	-0.375	-0.25
-14.4	-0.125	-0.125	0	0.375

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH ($mm H_2O$)	**CMT 130** R=4.2m TH ($mm H_2O$)	**CMT 129** R=4.7m TH ($mm H_2O$)	**CMT 128** R=3.7m TH ($mm H_2O$)	**SLS** ($mm^2 H_2O$)
-2.4	-0.57	-0.57	-0.57	-0.57	0.80
-4.4	-2.21	-2.12	-1.88	-2.38	2.96
-6.4	-0.89	-0.88	-0.85	-0.90	0.30
-8.4	-0.38	-0.38	-0.38	-0.39	0.18
-10.4	-0.23	-0.23	-0.23	-0.23	0.33
-12.4	-0.16	-0.16	-0.16	-0.16	0.75
-14.4	-0.13	-0.13	-0.13	-0.13	0.27
				Total	5.59



NOTES:
- i.e. -R=3.7m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

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Packer Test:	**140909-A-VERT-3**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^oC)	7.6
Ambient Barometric Pressure (kPa)	100.3
Center of Test Interval (mbss)	4.49
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.32E-02	2.00E-02
1.75E-02	2.64E-02
1.32E-02	2.00E-02
9.20E-03	1.39E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	1000.00

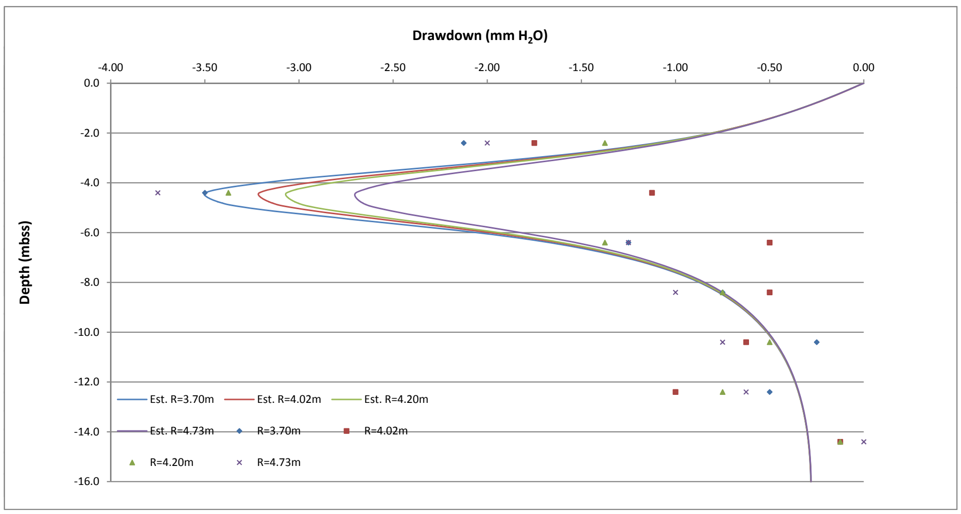
K_{gx} (m/s)	A_{gr} (-)	**KD** (-)
4.00E-04	0.075	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m ($mm\ H_2O$)	**CMT 130** R=4.2m ($mm\ H_2O$)	**CMT 129** R=4.7m ($mm\ H_2O$)	**CMT 128** R=3.7m ($mm\ H_2O$)
-2.4	-1.75	-1.375	-2	-2.125
-4.4	-1.125	-3.375	-3.75	-3.5
-6.4	-0.5	-1.375	-1.25	-1.25
-8.4	-0.5	-0.75	-1	-0.75
-10.4	-0.625	-0.5	-0.75	-0.25
-12.4	-1	-0.75	-0.625	-0.5
-14.4	-0.125	-0.125	0	-0.125

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH ($mm\ H_2O$)	**CMT 130** R=4.2m TH ($mm\ H_2O$)	**CMT 129** R=4.7m TH ($mm\ H_2O$)	**CMT 128** R=3.7m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-2.4	-1.09	-1.08	-1.04	-1.10	2.48
-4.4	-3.21	-3.07	-2.70	-3.50	5.55
-6.4	-1.63	-1.60	-1.53	-1.67	1.58
-8.4	-0.77	-0.76	-0.75	-0.77	0.13
-10.4	-0.47	-0.47	-0.47	-0.48	0.15
-12.4	-0.35	-0.35	-0.35	-0.35	0.69
-14.4	-0.29	-0.29	-0.29	-0.29	0.17
				Total	10.76



NOTES:
- i.e. -R=3.7m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**140909-A-VERT-3**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^oC)	7.6
Ambient Barometric Pressure (kPa)	100.3
Center of Test Interval (mbss)	4.49
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.32E-02	2.00E-02
1.75E-02	2.64E-02
1.32E-02	2.00E-02
9.20E-03	1.39E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	1000.00

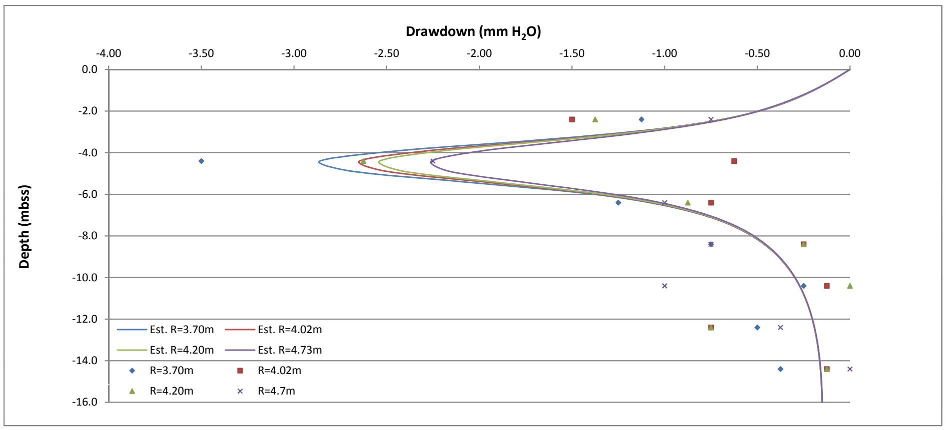
K_{gx} (m/s)	A_{gr} (-)	KD (-)
5.00E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m ($mm\ H_2O$)	**CMT 130** R=4.2m ($mm\ H_2O$)	**CMT 129** R=4.7m ($mm\ H_2O$)	**CMT 128** R=3.7m ($mm\ H_2O$)
-2.4	-1.5	-1.375	-0.75	-1.125
-4.4	-0.625	-2.625	-2.25	-3.5
-6.4	-0.75	-0.875	-1	-1.25
-8.4	-0.25	-0.25	-0.75	-0.75
-10.4	-0.125	0	-1	-0.25
-12.4	-0.75	-0.75	-0.375	-0.5
-14.4	-0.125	-0.125	0	-0.375

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH ($mm\ H_2O$)	**CMT 130** R=4.2m TH ($mm\ H_2O$)	**CMT 129** R=4.7m TH ($mm\ H_2O$)	**CMT 128** R=3.7m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-2.4	-0.69	-0.69	-0.68	-0.69	1.33
-4.4	-2.65	-2.54	-2.26	-2.86	4.50
-6.4	-1.06	-1.05	-1.02	-1.08	0.16
-8.4	-0.46	-0.46	-0.46	-0.46	0.26
-10.4	-0.27	-0.27	-0.27	-0.27	0.63
-12.4	-0.19	-0.19	-0.19	-0.19	0.75
-14.4	-0.16	-0.16	-0.16	-0.16	0.07
				Total	7.70



NOTES:
- i.e. -R=3.7m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	140909-A-VERT-3	FLOW RATE 5
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^{o}C)	7.6
Ambient Barometric Pressure (kPa)	100.3
Center of Test Interval (mbss)	4.49
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	Flux (m/s)
9.44E-03	1.43E-02
1.32E-02	2.00E-02
1.75E-02	2.64E-02
1.32E-02	2.00E-02
9.20E-03	1.39E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	1000.00

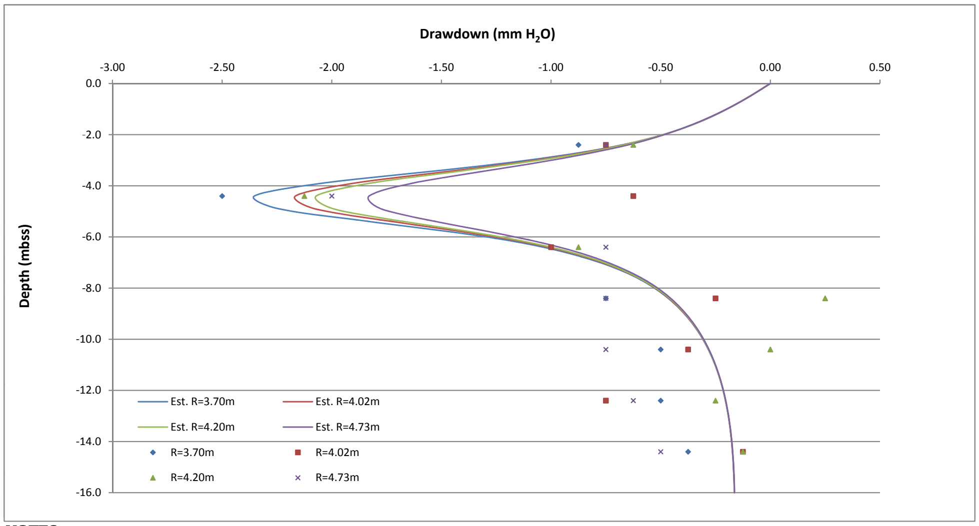
K_{gx} (m/s)	A_{gr} (-)	KD (-)
3.50E-04	0.06	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	CMT 131 R=4.02m (mm H_2O)	CMT 130 R=4.2m (mm H_2O)	CMT 129 R=4.7m (mm H_2O)	CMT 128 R=3.7m (mm H_2O)
-2.4	-0.75	-0.625	-0.75	-0.875
-4.4	-0.625	-2.125	-2	-2.5
-6.4	-1	-0.875	-0.75	-1
-8.4	-0.25	0.25	-0.75	-0.75
-10.4	-0.375	0	-0.75	-0.5
-12.4	-0.75	-0.25	-0.625	-0.5
-14.4	-0.125	-0.125	-0.5	-0.375

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	CMT 131 R=4.02m TH (mm H_2O)	CMT 130 R=4.2m TH (mm H_2O)	CMT 129 R=4.7m TH (mm H_2O)	CMT 128 R=3.7m TH (mm H_2O)	SLS (mm^2 H_2O)
-2.4	-0.67	-0.67	-0.65	-0.68	0.06
-4.4	-2.17	-2.07	-1.83	-2.35	2.43
-6.4	-1.01	-1.00	-0.96	-1.04	0.06
-8.4	-0.46	-0.46	-0.45	-0.47	0.72
-10.4	-0.28	-0.28	-0.28	-0.28	0.36
-12.4	-0.20	-0.20	-0.20	-0.21	0.56
-14.4	-0.17	-0.17	-0.17	-0.17	0.15
				Total	4.34



NOTES:

- i.e. -R=3.7m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**140909-A-VERT-4**	**FLOW RATE 1**
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^oC)	8.1
Ambient Barometric Pressure (kPa)	100.3
Center of Test Interval (mbss)	5.87
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
8.50E-03	1.29E-02
9.91E-03	1.50E-02
1.25E-02	1.89E-02
9.91E-03	1.50E-02
8.26E-03	1.25E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.24	999.84

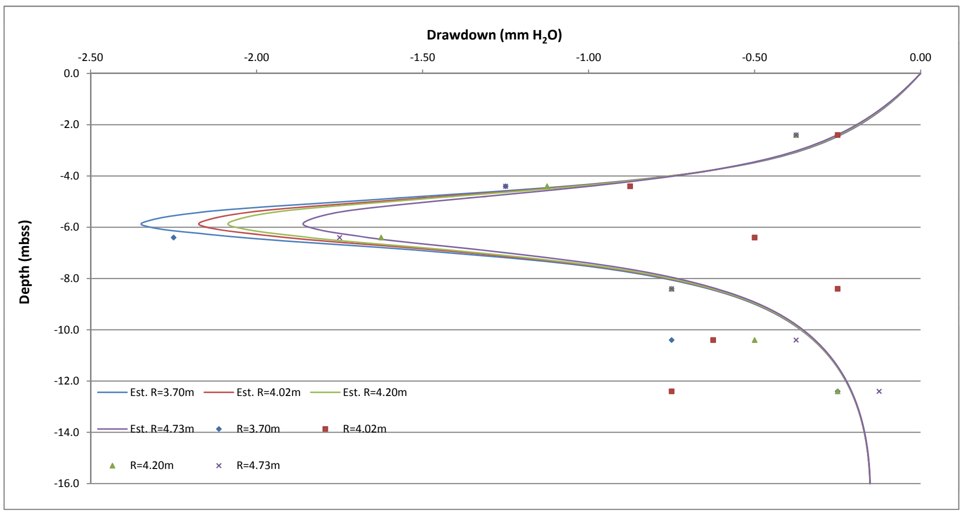
K_{gx} (m/s)	A_{gr} (-)	KD (-)
4.00E-04	0.04	1

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m ($mm\ H_2O$)	**CMT 130** R=4.2m ($mm\ H_2O$)	**CMT 129** R=4.7m ($mm\ H_2O$)	**CMT 128** R=3.7m ($mm\ H_2O$)
-2.4	-0.25	-0.375	-0.375	-0.375
-4.4	-0.875	-1.125	-1.25	-1.25
-6.4	-0.5	-1.625	-1.75	-2.25
-8.4	-0.25	-0.75	-0.75	-0.75
-10.4	-0.625	-0.5	-0.375	-0.75
-12.4	-0.75	-0.25	-0.125	-0.25
-14.4	-0.125	-0.125	0	-0.125

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH ($mm\ H_2O$)	**CMT 130** R=4.2m TH ($mm\ H_2O$)	**CMT 129** R=4.7m TH ($mm\ H_2O$)	**CMT 128** R=3.7m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-2.4	-0.24	-0.25	-0.25	-0.24	0.05
-4.4	-1.05	-1.03	-1.00	-1.07	0.14
-6.4	-1.91	-1.84	-1.67	-2.04	2.09
-8.4	-0.63	-0.63	-0.61	-0.64	0.19
-10.4	-0.32	-0.32	-0.32	-0.32	0.31
-12.4	-0.21	-0.21	-0.21	-0.21	0.30
-14.4	-0.16	-0.16	-0.16	-0.16	0.03
				Total	3.11



NOTES:

- i.e. -R=3.7m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	140909-A-VERT-4	FLOW RATE 2
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^oC)	8.1
Ambient Barometric Pressure (kPa)	100.3
Center of Test Interval (mbss)	5.87
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	Flux (m/s)
8.50E-03	1.29E-02
9.91E-03	1.50E-02
1.25E-02	1.89E-02
9.91E-03	1.50E-02
8.26E-03	1.25E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.24	999.84

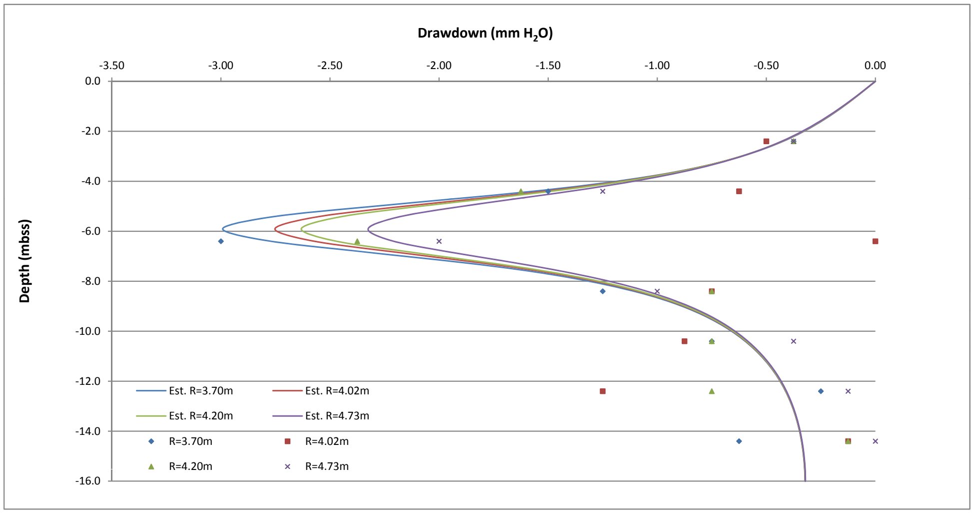
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.75E-04	0.075	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	CMT 131 R=4.02m ($mm\ H_2O$)	CMT 130 R=4.2m ($mm\ H_2O$)	CMT 129 R=4.7m ($mm\ H_2O$)	CMT 128 R=3.7m ($mm\ H_2O$)
-2.4	-0.5	-0.375	-0.375	-0.375
-4.4	-0.625	-1.625	-1.25	-1.5
-6.4	0	-2.375	-2	-3
-8.4	-0.75	-0.75	-1	-1.25
-10.4	-0.875	-0.75	-0.375	-0.75
-12.4	-1.25	-0.75	-0.125	-0.25
-14.4	-0.125	-0.125	0	-0.625

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	CMT 131 R=4.02m TH ($mm\ H_2O$)	CMT 130 R=4.2m TH ($mm\ H_2O$)	CMT 129 R=4.7m TH ($mm\ H_2O$)	CMT 128 R=3.7m TH ($mm\ H_2O$)	SLS ($mm^2\ H_2O$)
-2.4	-0.43	-0.43	-0.43	-0.42	0.01
-4.4	-1.51	-1.48	-1.40	-1.57	0.84
-6.4	-2.57	-2.47	-2.21	-2.77	6.72
-8.4	-1.09	-1.08	-1.05	-1.11	0.25
-10.4	-0.59	-0.59	-0.58	-0.60	0.17
-12.4	-0.41	-0.41	-0.41	-0.41	0.93
-14.4	-0.34	-0.34	-0.34	-0.34	0.29
				Total	9.20



NOTES:

- i.e. -R=3.7m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**140909-A-VERT-4**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^{o}C)	8.1
Ambient Barometric Pressure (kPa)	100.3
Center of Test Interval (mbss)	5.87
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
8.50E-03	1.29E-02
9.91E-03	1.50E-02
1.25E-02	1.89E-02
9.91E-03	1.50E-02
8.26E-03	1.25E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.24	999.84

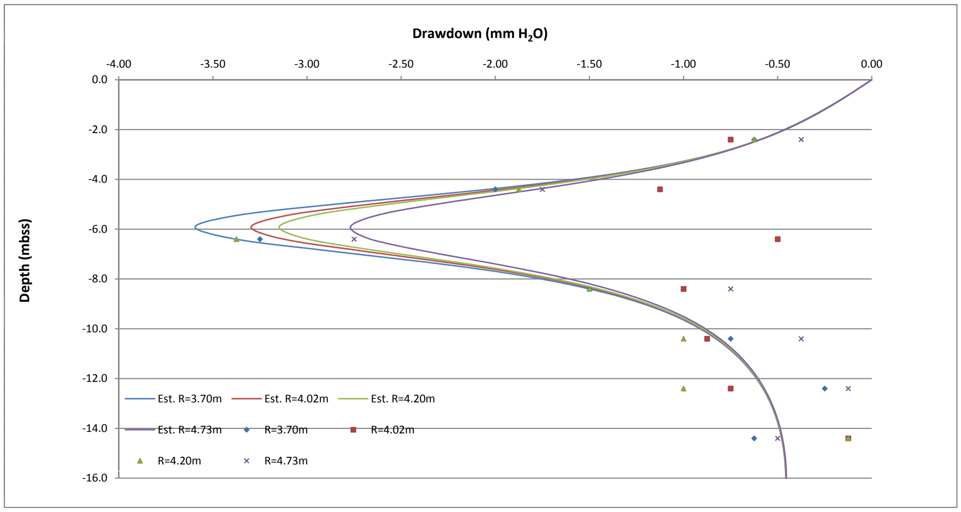
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.50E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m ($mm\ H_2O$)	**CMT 130** R=4.2m ($mm\ H_2O$)	**CMT 129** R=4.7m ($mm\ H_2O$)	**CMT 128** R=3.7m ($mm\ H_2O$)
-2.4	-0.75	-0.625	-0.375	-0.625
-4.4	-1.125	-1.875	-1.75	-2
-6.4	-0.5	-3.375	-2.75	-3.25
-8.4	-1	-1.5	-0.75	-1.5
-10.4	-0.875	-1	-0.375	-0.75
-12.4	-0.75	-1	-0.125	-0.25
-14.4	-0.125	-0.125	-0.5	-0.625

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH ($mm\ H_2O$)	**CMT 130** R=4.2m TH ($mm\ H_2O$)	**CMT 129** R=4.7m TH ($mm\ H_2O$)	**CMT 128** R=3.7m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-2.4	-0.59	-0.59	-0.59	-0.59	0.07
-4.4	-1.96	-1.91	-1.78	-2.04	0.69
-6.4	-3.13	-3.00	-2.66	-3.38	7.07
-8.4	-1.47	-1.45	-1.40	-1.50	0.64
-10.4	-0.82	-0.82	-0.81	-0.83	0.23
-12.4	-0.58	-0.58	-0.57	-0.58	0.52
-14.4	-0.48	-0.48	-0.47	-0.48	0.27
				Total	9.49



NOTES:
- i.e. -R=3.7m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test: **140909-A-VERT-4** **FLOW RATE 4**

Client: Syncrude Canada Ltd.

Test Date	14-Sep-09
Test Interval Temperature (^oC)	8.1
Ambient Barometric Pressure (kPa)	100.3
Center of Test Interval (mbss)	5.87
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
8.50E-03	1.29E-02
9.91E-03	1.50E-02
1.25E-02	1.89E-02
9.91E-03	1.50E-02
8.26E-03	1.25E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.24	999.84

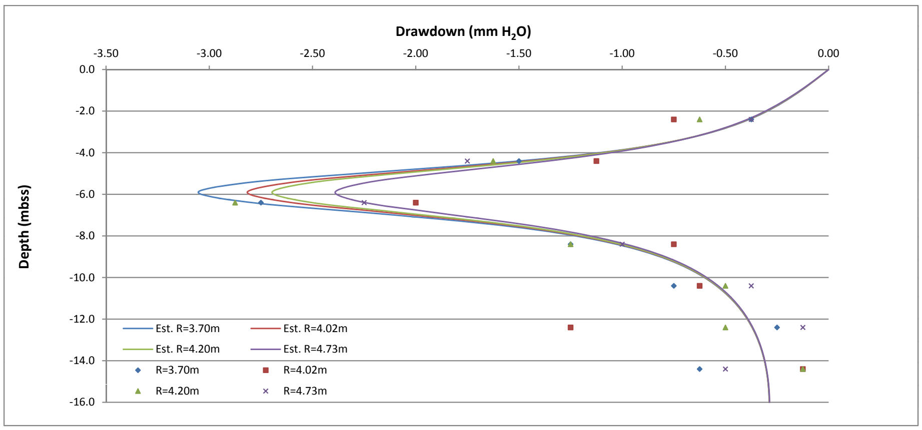
K_{gx} (m/s)	A_{gr} (-)	KD (-)
3.00E-04	0.06	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m ($mm\ H_2O$)	**CMT 130** R=4.2m ($mm\ H_2O$)	**CMT 129** R=4.7m ($mm\ H_2O$)	**CMT 128** R=3.7m ($mm\ H_2O$)
-2.4	-0.75	-0.625	-0.375	-0.375
-4.4	-1.125	-1.625	-1.75	-1.5
-6.4	-2	-2.875	-2.25	-2.75
-8.4	-0.75	-1.25	-1	-1.25
-10.4	-0.625	-0.5	-0.375	-0.75
-12.4	-1.25	-0.5	-0.125	-0.25
-14.4	-0.125	-0.125	-0.5	-0.625

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH ($mm\ H_2O$)	**CMT 130** R=4.2m TH ($mm\ H_2O$)	**CMT 129** R=4.7m TH ($mm\ H_2O$)	**CMT 128** R=3.7m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-2.4	-0.39	-0.39	-0.39	-0.38	0.19
-4.4	-1.46	-1.43	-1.36	-1.50	0.30
-6.4	-2.60	-2.50	-2.25	-2.79	0.50
-8.4	-1.01	-1.01	-0.98	-1.03	0.18
-10.4	-0.54	-0.54	-0.53	-0.54	0.08
-12.4	-0.37	-0.37	-0.37	-0.37	0.86
-14.4	-0.30	-0.30	-0.30	-0.30	0.21
				Total	2.32



NOTES:

- i.e. -R=3.7m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**140909-A-VERT-4**	**FLOW RATE 5**
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^oC)	8.1
Ambient Barometric Pressure (kPa)	100.3
Center of Test Interval (mbss)	5.87
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
8.50E-03	1.29E-02
9.91E-03	1.50E-02
1.25E-02	1.89E-02
9.91E-03	1.50E-02
8.26E-03	1.25E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.24	999.84

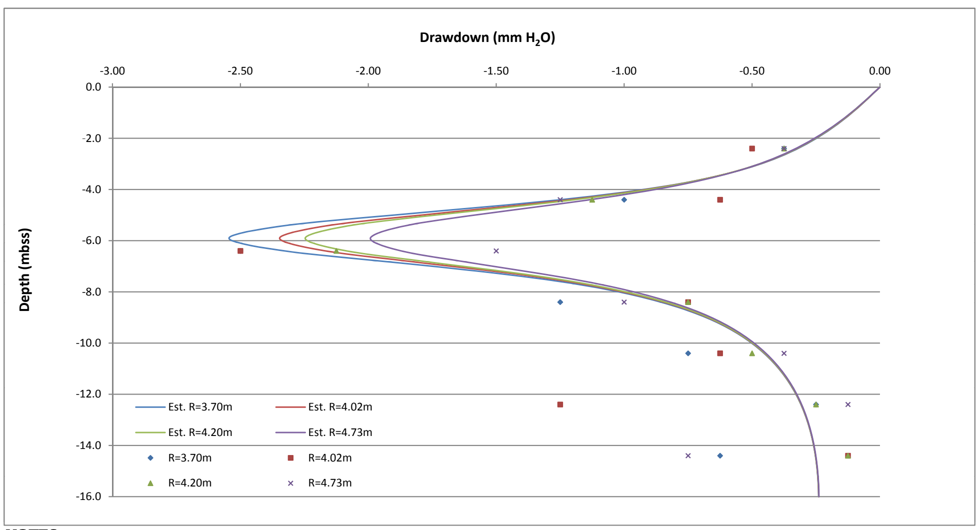
K_{gx} (m/s)	A_{gr} (-)	KD (-)
3.00E-04	0.06	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m ($mm H_2O$)	**CMT 130** R=4.2m ($mm H_2O$)	**CMT 129** R=4.7m ($mm H_2O$)	**CMT 128** R=3.7m ($mm H_2O$)
-2.4	-0.5	-0.375	-0.375	-0.375
-4.4	-0.625	-1.125	-1.25	-1
-6.4	-2.5	-2.125	-1.5	-2.5
-8.4	-0.75	-0.75	-1	-1.25
-10.4	-0.625	-0.5	-0.375	-0.75
-12.4	-1.25	-0.25	-0.125	-0.25
-14.4	-0.125	-0.125	-0.75	-0.625

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH ($mm H_2O$)	**CMT 130** R=4.2m TH ($mm H_2O$)	**CMT 129** R=4.7m TH ($mm H_2O$)	**CMT 128** R=3.7m TH ($mm H_2O$)	**SLS** ($mm^2 H_2O$)
-2.4	-0.32	-0.33	-0.33	-0.32	0.04
-4.4	-1.21	-1.19	-1.13	-1.25	0.43
-6.4	-2.17	-2.09	-1.87	-2.33	0.28
-8.4	-0.85	-0.84	-0.82	-0.86	0.20
-10.4	-0.45	-0.45	-0.45	-0.45	0.13
-12.4	-0.31	-0.31	-0.31	-0.31	0.93
-14.4	-0.25	-0.25	-0.25	-0.25	0.42
				Total	2.42



NOTES:
- i.e. -R=3.7m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**140909-A-VERT-5**	**FLOW RATE 1**
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^oC)	8.6
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	7.25
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
8.50E-03	1.29E-02
1.09E-02	1.64E-02
1.65E-02	2.50E-02
1.01E-02	1.54E-02
8.50E-03	1.29E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.24	999.81

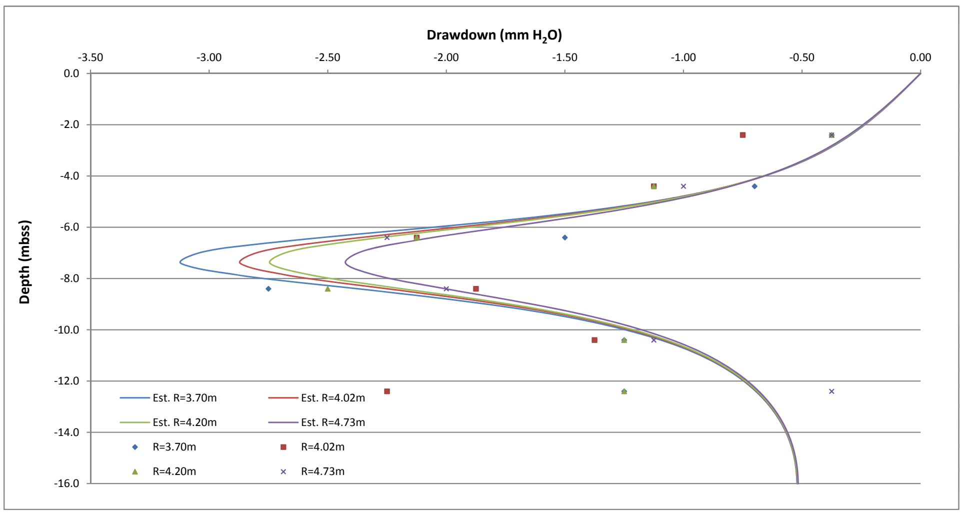
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.00E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m ($mm H_2O$)	**CMT 130** R=4.2m ($mm H_2O$)	**CMT 129** R=4.7m ($mm H_2O$)	**CMT 128** R=3.7m ($mm H_2O$)
-2.4	-0.75	-0.375	-0.375	-0.375
-4.4	-1.125	-1.125	-1	-0.7
-6.4	-2.125	-2.125	-2.25	-1.5
-8.4	-1.875	-2.5	-2	-2.75
-10.4	-1.375	-1.25	-1.125	-1.25
-12.4	-2.25	-1.25	-0.375	-1.25
-14.4	-0.625	-0.625	-0.25	-0.875

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH ($mm H_2O$)	**CMT 130** R=4.2m TH ($mm H_2O$)	**CMT 129** R=4.7m TH ($mm H_2O$)	**CMT 128** R=3.7m TH ($mm H_2O$)	**SLS** ($mm^2 H_2O$)
-2.4	-0.30	-0.30	-0.30	-0.29	0.22
-4.4	-0.81	-0.81	-0.80	-0.81	0.25
-6.4	-2.36	-2.28	-2.06	-2.52	1.17
-8.4	-2.25	-2.18	-2.00	-2.37	0.38
-10.4	-1.08	-1.07	-1.05	-1.10	0.15
-12.4	-0.69	-0.69	-0.68	-0.69	3.15
-14.4	-0.55	-0.55	-0.54	-0.55	0.20
				Total	5.52



NOTES:
- i.e. -R=3.7m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test: **140909-A-VERT-5** **FLOW RATE 2**

Client: Syncrude Canada Ltd.

Test Date	14-Sep-09
Test Interval Temperature (^oC)	8.6
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	7.25
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
8.50E-03	1.29E-02
1.09E-02	1.64E-02
1.65E-02	2.50E-02
1.01E-02	1.54E-02
8.50E-03	1.29E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.24	999.81

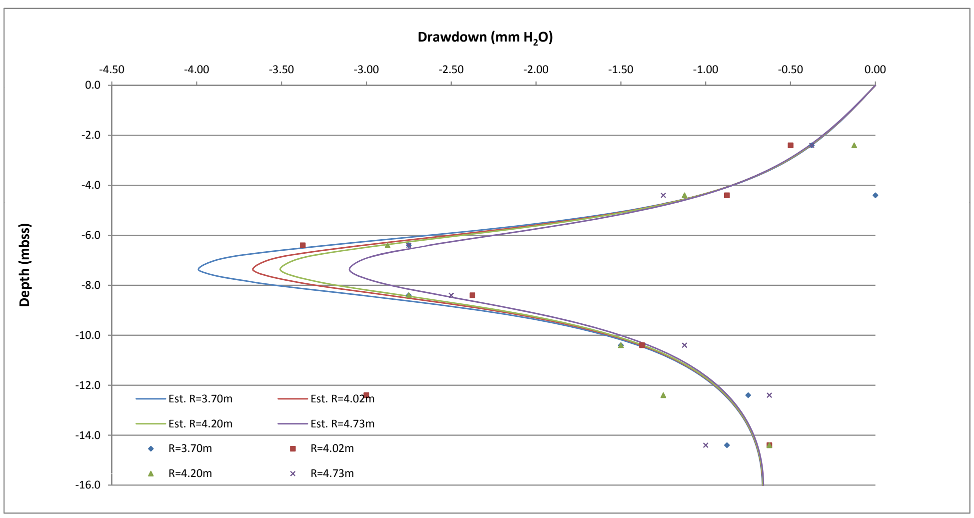
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.00E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m (mm H_2O)	**CMT 130** R=4.2m (mm H_2O)	**CMT 129** R=4.7m (mm H_2O)	**CMT 128** R=3.7m (mm H_2O)
-2.4	-0.5	-0.125	-0.375	-0.375
-4.4	-0.875	-1.125	-1.25	0
-6.4	-3.375	-2.875	-2.75	-2.75
-8.4	-2.375	-2.75	-2.5	-2.75
-10.4	-1.375	-1.5	-1.125	-1.5
-12.4	-3	-1.25	-0.625	-0.75
-14.4	-0.625	-0.625	-1	-0.875

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH (mm H_2O)	**CMT 130** R=4.2m TH (mm H_2O)	**CMT 129** R=4.7m TH (mm H_2O)	**CMT 128** R=3.7m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-2.4	-0.38	-0.38	-0.39	-0.38	0.08
-4.4	-1.04	-1.03	-1.02	-1.04	1.16
-6.4	-3.02	-2.91	-2.63	-3.23	0.37
-8.4	-2.87	-2.79	-2.56	-3.03	0.33
-10.4	-1.38	-1.37	-1.34	-1.40	0.07
-12.4	-0.88	-0.88	-0.87	-0.89	4.70
-14.4	-0.70	-0.70	-0.70	-0.70	0.13
				Total	6.85



NOTES:

- i.e. -R=3.7m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**140909-A-VERT-5**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^oC)	8.6
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	7.25
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
8.50E-03	1.29E-02
1.09E-02	1.64E-02
1.65E-02	2.50E-02
1.01E-02	1.54E-02
8.50E-03	1.29E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.24	999.81

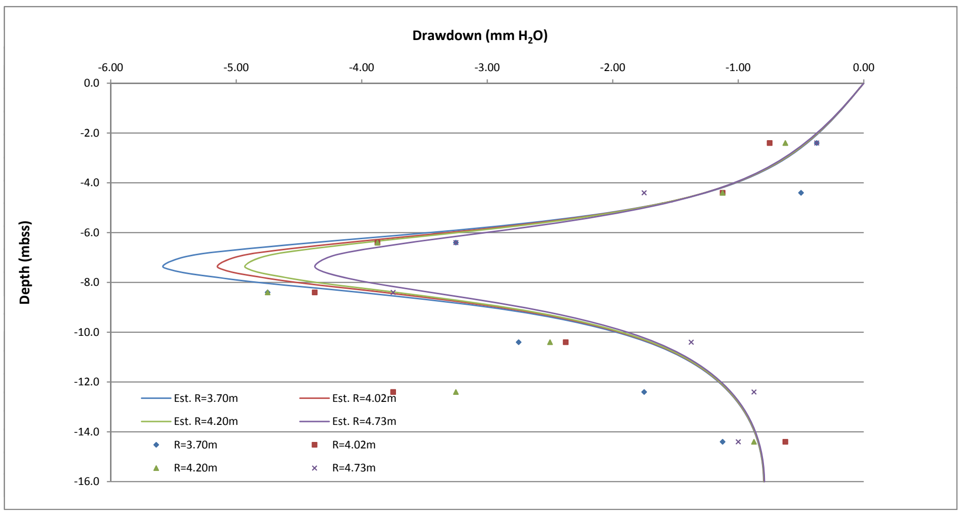
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.50E-04	0.075	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m ($mm H_2O$)	**CMT 130** R=4.2m ($mm H_2O$)	**CMT 129** R=4.7m ($mm H_2O$)	**CMT 128** R=3.7m ($mm H_2O$)
-2.4	-0.75	-0.625	-0.375	-0.375
-4.4	-1.125	-1.125	-1.75	-0.5
-6.4	-3.875	-3.875	-3.25	-3.25
-8.4	-4.375	-4.75	-3.75	-4.75
-10.4	-2.375	-2.5	-1.375	-2.75
-12.4	-3.75	-3.25	-0.875	-1.75
-14.4	-0.625	-0.875	-1	-1.125

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH ($mm H_2O$)	**CMT 130** R=4.2m TH ($mm H_2O$)	**CMT 129** R=4.7m TH ($mm H_2O$)	**CMT 128** R=3.7m TH ($mm H_2O$)	**SLS** ($mm^2 H_2O$)
-2.4	-0.46	-0.46	-0.47	-0.45	0.13
-4.4	-1.27	-1.27	-1.27	-1.26	0.85
-6.4	-4.12	-3.98	-3.62	-4.38	1.48
-8.4	-3.83	-3.73	-3.45	-4.02	1.97
-10.4	-1.71	-1.70	-1.66	-1.72	2.23
-12.4	-1.07	-1.07	-1.06	-1.07	12.44
-14.4	-0.84	-0.84	-0.84	-0.84	0.15
				Total	19.27



NOTES:
- i.e. -R=3.7m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

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Packer Test:	140909-A-VERT-5	FLOW RATE 4
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^oC)	8.6
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	7.25
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	Flux (m/s)
8.50E-03	1.29E-02
1.09E-02	1.64E-02
1.65E-02	2.50E-02
1.01E-02	1.54E-02
8.50E-03	1.29E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.24	999.81

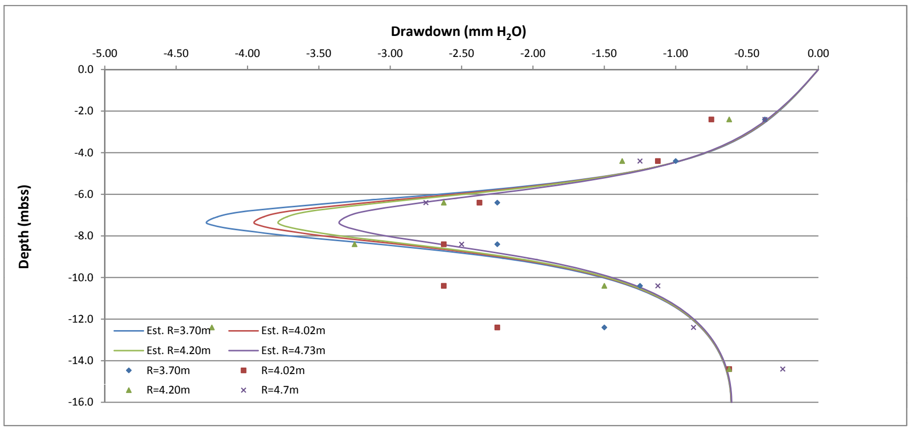
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.00E-04	0.075	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	CMT 131 R=4.02m ($mm\ H_2O$)	CMT 130 R=4.2m ($mm\ H_2O$)	CMT 129 R=4.7m ($mm\ H_2O$)	CMT 128 R=3.7m ($mm\ H_2O$)
-2.4	-0.75	-0.625	-0.375	-0.375
-4.4	-1.125	-1.375	-1.25	-1
-6.4	-2.375	-2.625	-2.75	-2.25
-8.4	-2.625	-3.25	-2.5	-2.25
-10.4	-2.625	-1.5	-1.125	-1.25
-12.4	-2.25	-4.25	-0.875	-1.5
-14.4	-0.625	-0.625	-0.25	-0.625

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	CMT 131 R=4.02m TH ($mm\ H_2O$)	CMT 130 R=4.2m TH ($mm\ H_2O$)	CMT 129 R=4.7m TH ($mm\ H_2O$)	CMT 128 R=3.7m TH ($mm\ H_2O$)	SLS ($mm^2\ H_2O$)
-2.4	-0.35	-0.35	-0.36	-0.35	0.23
-4.4	-0.97	-0.97	-0.97	-0.97	0.26
-6.4	-3.16	-3.06	-2.78	-3.36	2.04
-8.4	-2.94	-2.86	-2.65	-3.08	0.97
-10.4	-1.31	-1.30	-1.28	-1.32	1.80
-12.4	-0.82	-0.82	-0.81	-0.82	14.27
-14.4	-0.65	-0.65	-0.64	-0.65	0.16
				Total	19.73



NOTES:

- i.e. -R=3.7m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test: **140909-A-VERT-5** **FLOW RATE 5**

Client: Syncrude Canada Ltd.

Test Date	14-Sep-09
Test Interval Temperature (^oC)	8.6
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	7.25
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
8.50E-03	1.29E-02
1.09E-02	1.64E-02
1.65E-02	2.50E-02
1.01E-02	1.54E-02
8.50E-03	1.29E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.24	999.81

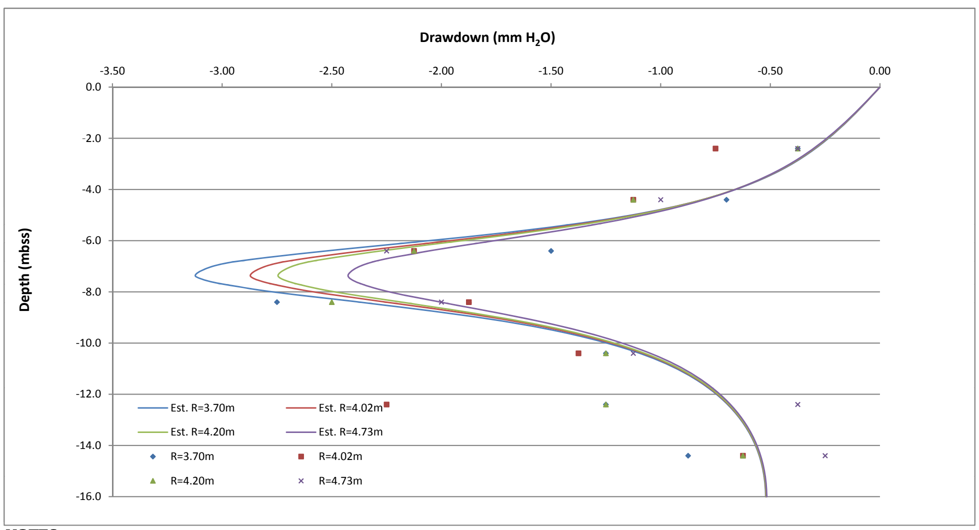
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.00E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m ($mm\ H_2O$)	**CMT 130** R=4.2m ($mm\ H_2O$)	**CMT 129** R=4.7m ($mm\ H_2O$)	**CMT 128** R=3.7m ($mm\ H_2O$)
-2.4	-0.75	-0.375	-0.375	-0.375
-4.4	-1.125	-1.125	-1	-0.7
-6.4	-2.125	-2.125	-2.25	-1.5
-8.4	-1.875	-2.5	-2	-2.75
-10.4	-1.375	-1.25	-1.125	-1.25
-12.4	-2.25	-1.25	-0.375	-1.25
-14.4	-0.625	-0.625	-0.25	-0.875

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH ($mm\ H_2O$)	**CMT 130** R=4.2m TH ($mm\ H_2O$)	**CMT 129** R=4.7m TH ($mm\ H_2O$)	**CMT 128** R=3.7m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-2.4	-0.30	-0.30	-0.30	-0.29	0.22
-4.4	-0.81	-0.81	-0.80	-0.81	0.25
-6.4	-2.36	-2.28	-2.06	-2.52	1.17
-8.4	-2.25	-2.18	-2.00	-2.37	0.38
-10.4	-1.08	-1.07	-1.05	-1.10	0.15
-12.4	-0.69	-0.69	-0.68	-0.69	3.15
-14.4	-0.55	-0.55	-0.54	-0.55	0.20
				Total	5.52



NOTES:

- i.e. -R=3.7m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**140909-A-VERT-6**	**FLOW RATE 1**
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^oC)	9.2
Ambient Barometric Pressure (kPa)	101.1
Center of Test Interval (mbss)	8.63
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
8.97E-03	1.36E-02
1.23E-02	1.86E-02
1.59E-02	2.41E-02
1.23E-02	1.86E-02
8.73E-03	1.32E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.71E-05	1.25	999.77

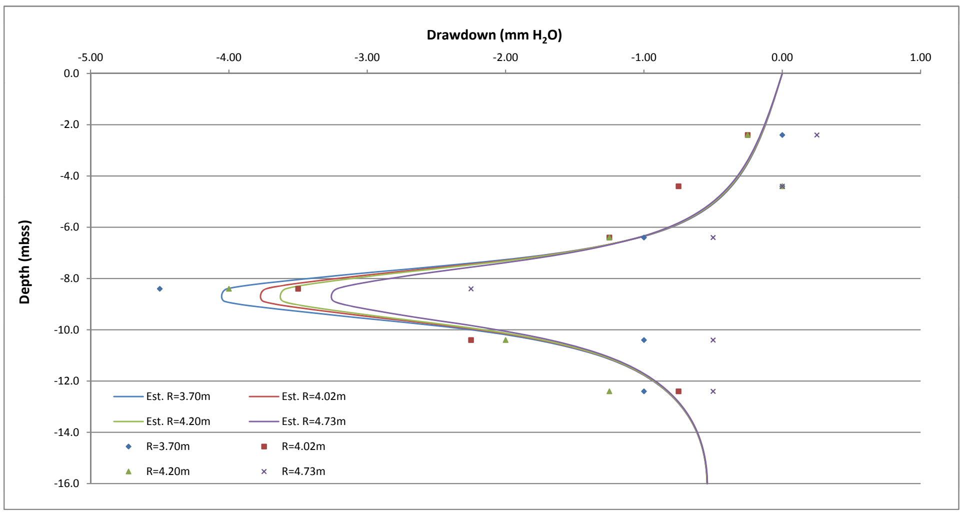
K_{gx} (m/s)	A_{gr} (-)	**KD** (-)
2.50E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m ($mm\ H_2O$)	**CMT 130** R=4.2m ($mm\ H_2O$)	**CMT 129** R=4.7m ($mm\ H_2O$)	**CMT 128** R=3.7m ($mm\ H_2O$)
-2.4	-0.25	-0.25	0.25	0
-4.4	-0.75	0	0	0
-6.4	-1.25	-1.25	-0.5	-1
-8.4	-3.5	-4	-2.25	-4.5
-10.4	-2.25	-2	-0.5	-1
-12.4	-0.75	-1.25	-0.5	-1
-14.4	-0.5	-0.5	-0.5	-0.5

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH ($mm\ H_2O$)	**CMT 130** R=4.2m TH ($mm\ H_2O$)	**CMT 129** R=4.7m TH ($mm\ H_2O$)	**CMT 128** R=3.7m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-2.4	-0.15	-0.15	-0.16	-0.15	0.21
-4.4	-0.37	-0.38	-0.38	-0.37	0.57
-6.4	-1.04	-1.04	-1.04	-1.03	0.38
-8.4	-3.73	-3.59	-3.22	-4.01	1.40
-10.4	-1.75	-1.73	-1.68	-1.78	2.32
-12.4	-0.83	-0.83	-0.82	-0.84	0.31
-14.4	-0.59	-0.59	-0.59	-0.59	0.03
				Total	5.22



NOTES:
- i.e. -R=3.7m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

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Packer Test:	**140909-A-VERT-6**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^oC)	9.2
Ambient Barometric Pressure (kPa)	101.1
Center of Test Interval (mbss)	8.63
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
8.97E-03	1.36E-02
1.23E-02	1.86E-02
1.59E-02	2.41E-02
1.23E-02	1.86E-02
8.73E-03	1.32E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.71E-05	1.25	999.77

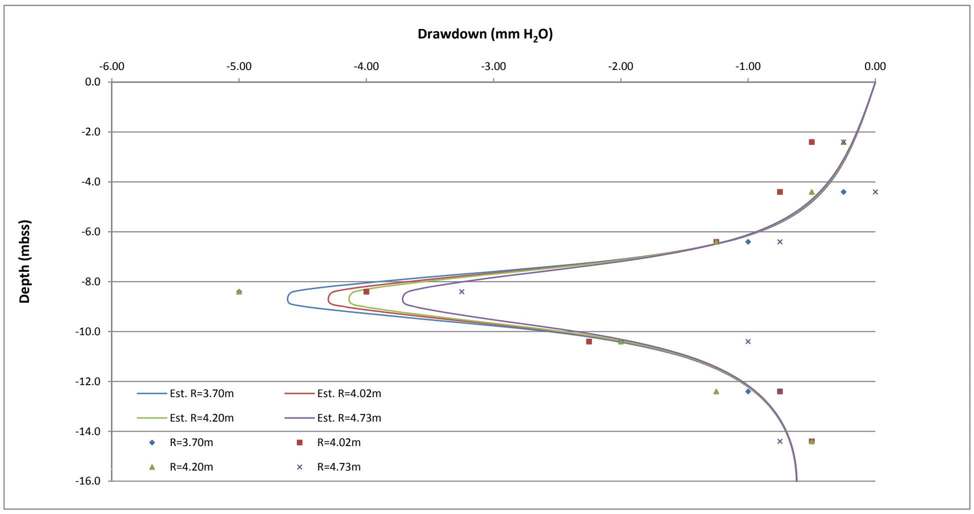
K_{gx} (m/s)	A_{gr} (-)	**KD** (-)
3.00E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m ($mm\ H_2O$)	**CMT 130** R=4.2m ($mm\ H_2O$)	**CMT 129** R=4.7m ($mm\ H_2O$)	**CMT 128** R=3.7m ($mm\ H_2O$)
-2.4	-0.5	-0.25	-0.25	-0.5
-4.4	-0.75	-0.5	0	-0.25
-6.4	-1.25	-1.25	-0.75	-1
-8.4	-4	-5	-3.25	-5
-10.4	-2.25	-2	-1	-2
-12.4	-0.75	-1.25	-0.75	-1
-14.4	-0.5	-0.5	-0.75	-0.5

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH ($mm\ H_2O$)	**CMT 130** R=4.2m TH ($mm\ H_2O$)	**CMT 129** R=4.7m TH ($mm\ H_2O$)	**CMT 128** R=3.7m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-2.4	-0.17	-0.18	-0.18	-0.17	0.22
-4.4	-0.43	-0.43	-0.44	-0.42	0.33
-6.4	-1.18	-1.18	-1.18	-1.18	0.23
-8.4	-4.25	-4.09	-3.67	-4.58	1.25
-10.4	-1.99	-1.97	-1.91	-2.02	0.90
-12.4	-0.95	-0.95	-0.94	-0.95	0.17
-14.4	-0.67	-0.67	-0.67	-0.67	0.10
				Total	3.20



NOTES:
- i.e. -R=3.7m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test: **140909-A-VERT-6** **FLOW RATE 3**

Client: Syncrude Canada Ltd.

Test Date	14-Sep-09
Test Interval Temperature (^oC)	9.2
Ambient Barometric Pressure (kPa)	101.1
Center of Test Interval (mbss)	8.63
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
8.97E-03	1.36E-02
1.23E-02	1.86E-02
1.59E-02	2.41E-02
1.23E-02	1.86E-02
8.73E-03	1.32E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.71E-05	1.25	999.77

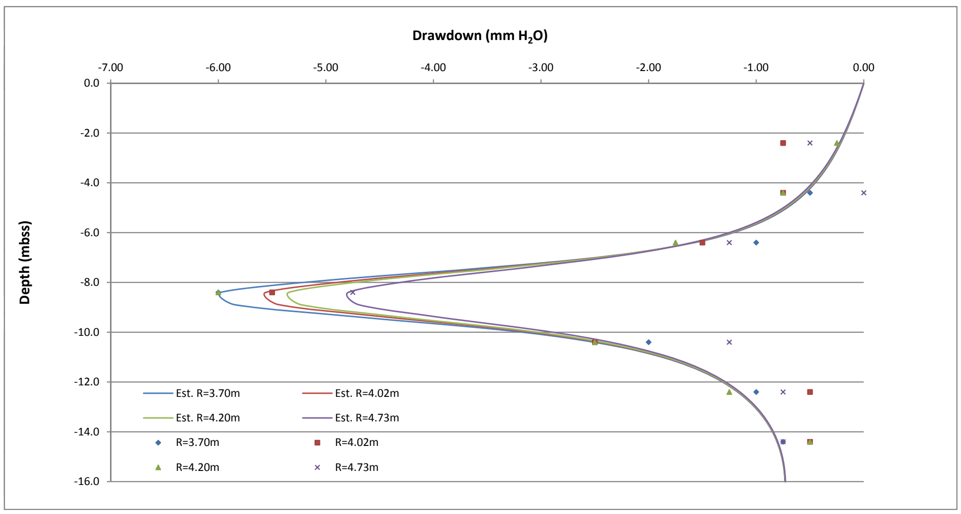
K_{gx} (m/s)	A_{gr} (-)	KD (-)
3.00E-04	0.04	1

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m ($mm\ H_2O$)	**CMT 130** R=4.2m ($mm\ H_2O$)	**CMT 129** R=4.7m ($mm\ H_2O$)	**CMT 128** R=3.7m ($mm\ H_2O$)
-2.4	-0.75	-0.25	-0.5	-0.75
-4.4	-0.75	-0.75	0	-0.5
-6.4	-1.5	-1.75	-1.25	-1
-8.4	-5.5	-6	-4.75	-6
-10.4	-2.5	-2.5	-1.25	-2
-12.4	-0.5	-1.25	-0.75	-1
-14.4	-0.5	-0.5	-0.75	-0.75

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH ($mm\ H_2O$)	**CMT 130** R=4.2m TH ($mm\ H_2O$)	**CMT 129** R=4.7m TH ($mm\ H_2O$)	**CMT 128** R=3.7m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-2.4	-0.22	-0.22	-0.23	-0.21	0.65
-4.4	-0.55	-0.56	-0.57	-0.54	0.40
-6.4	-1.58	-1.59	-1.59	-1.57	0.47
-8.4	-5.56	-5.34	-4.79	-5.98	0.44
-10.4	-2.46	-2.43	-2.36	-2.51	1.48
-12.4	-1.17	-1.16	-1.15	-1.17	0.64
-14.4	-0.81	-0.80	-0.80	-0.81	0.19
				Total	4.28



NOTES:

- i.e. -R=3.7m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

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Packer Test:	**140909-A-VERT-6**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	14-Sep-09
Test Interval Temperature (^oC)	9.2
Ambient Barometric Pressure (kPa)	101.1
Center of Test Interval (mbss)	8.63
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
8.97E-03	1.36E-02
1.23E-02	1.86E-02
1.59E-02	2.41E-02
1.23E-02	1.86E-02
8.73E-03	1.32E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.71E-05	1.25	999.77

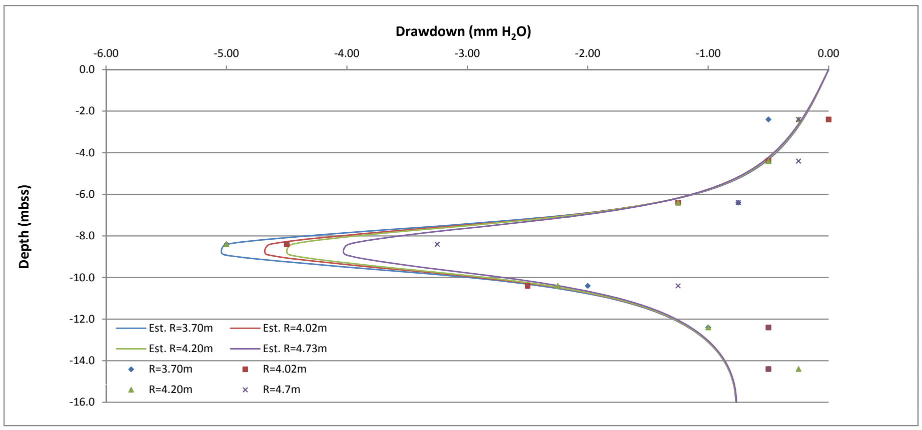
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.50E-04	0.05	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m (mm H_2O)	**CMT 130** R=4.2m (mm H_2O)	**CMT 129** R=4.7m (mm H_2O)	**CMT 128** R=3.7m (mm H_2O)
-2.4	0	-0.25	-0.25	-0.5
-4.4	-0.5	-0.5	-0.25	-0.5
-6.4	-1.25	-1.25	-0.75	-0.75
-8.4	-4.5	-5	-3.25	-5
-10.4	-2.5	-2.25	-1.25	-2
-12.4	-0.5	-1	-0.5	-1
-14.4	-0.5	-0.25	-0.5	-0.5

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH (mm H_2O)	**CMT 130** R=4.2m TH (mm H_2O)	**CMT 129** R=4.7m TH (mm H_2O)	**CMT 128** R=3.7m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-2.4	-0.22	-0.22	-0.22	-0.21	0.13
-4.4	-0.52	-0.53	-0.54	-0.52	0.09
-6.4	-1.43	-1.43	-1.42	-1.42	0.96
-8.4	-4.64	-4.45	-3.98	-5.00	0.85
-10.4	-2.35	-2.32	-2.24	-2.40	1.17
-12.4	-1.16	-1.15	-1.14	-1.16	0.90
-14.4	-0.83	-0.83	-0.83	-0.83	0.66
				Total	4.76



NOTES:
- i.e. -R=3.7m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test: **140909-A-VERT-6** **FLOW RATE 5**

Client: Syncrude Canada Ltd.

Test Date	14-Sep-09
Test Interval Temperature (^oC)	9.2
Ambient Barometric Pressure (kPa)	101.1
Center of Test Interval (mbss)	8.63
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
8.97E-03	1.36E-02
1.23E-02	1.86E-02
1.59E-02	2.41E-02
1.23E-02	1.86E-02
8.73E-03	1.32E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.71E-05	1.25	999.77

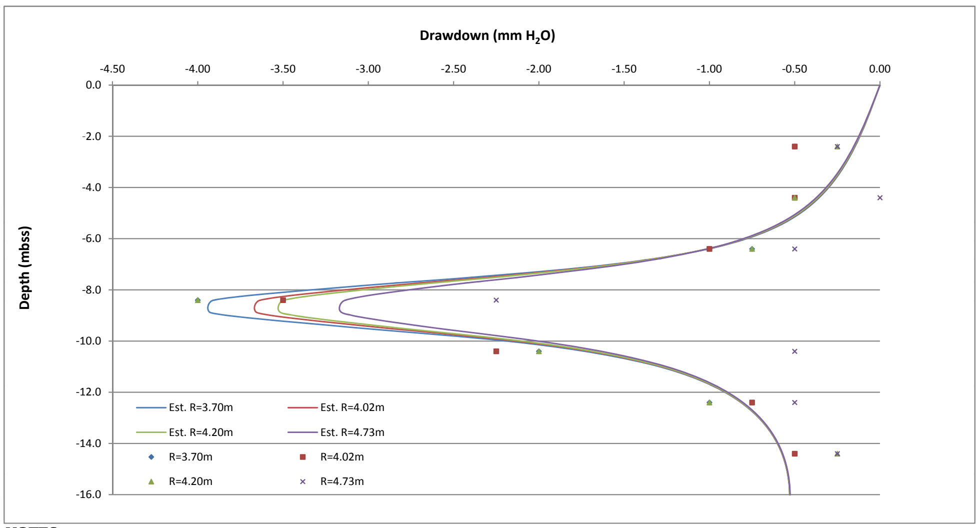
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.50E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth	**CMT 131**	**CMT 130**	**CMT 129**	**CMT 128**
	R=4.02m	R=4.2m	R=4.7m	R=3.7m
(mbss)	(mm H_2O)	(mm H_2O)	(mm H_2O)	(mm H_2O)
-2.4	-0.5	-0.25	-0.25	-0.5
-4.4	-0.5	-0.5	0	-0.5
-6.4	-1	-0.75	-0.5	-0.75
-8.4	-3.5	-4	-2.25	-4
-10.4	-2.25	-2	-0.5	-2
-12.4	-0.75	-1	-0.5	-1
-14.4	-0.5	-0.25	-0.25	-0.5

Simulated Drawdown at Monitoring Locations

Port Depth	**CMT 131**	**CMT 130**	**CMT 129**	**CMT 128**	**SLS**
	R=4.02m	R=4.2m	R=4.7m	R=3.7m	
(mbss)	TH (mm H_2O)	TH (mm H_2O)	TH (mm H_2O)	TH (mm H_2O)	(mm^2 H_2O)
-2.4	-0.15	-0.15	-0.15	-0.15	0.27
-4.4	-0.36	-0.37	-0.37	-0.36	0.20
-6.4	-1.01	-1.01	-1.01	-1.00	0.39
-8.4	-3.63	-3.49	-3.13	-3.91	1.06
-10.4	-1.70	-1.68	-1.63	-1.73	1.76
-12.4	-0.81	-0.81	-0.80	-0.81	0.17
-14.4	-0.57	-0.57	-0.57	-0.58	0.22
				Total	4.07



NOTES:

- i.e. -R=3.7m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

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Packer Test:	**150909-A-VERT-1**	**FLOW RATE 1**
Client:	Syncrude Canada Ltd.	

Test Date	15-Sep-09
Test Interval Temperature (^{o}C)	10.3
Ambient Barometric Pressure (kPa)	100.9
Center of Test Interval (mbss)	10.01
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
7.08E-03	1.07E-02
1.13E-02	1.71E-02
1.60E-02	2.43E-02
1.04E-02	1.57E-02
7.08E-03	1.07E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.71E-05	1.25	999.68

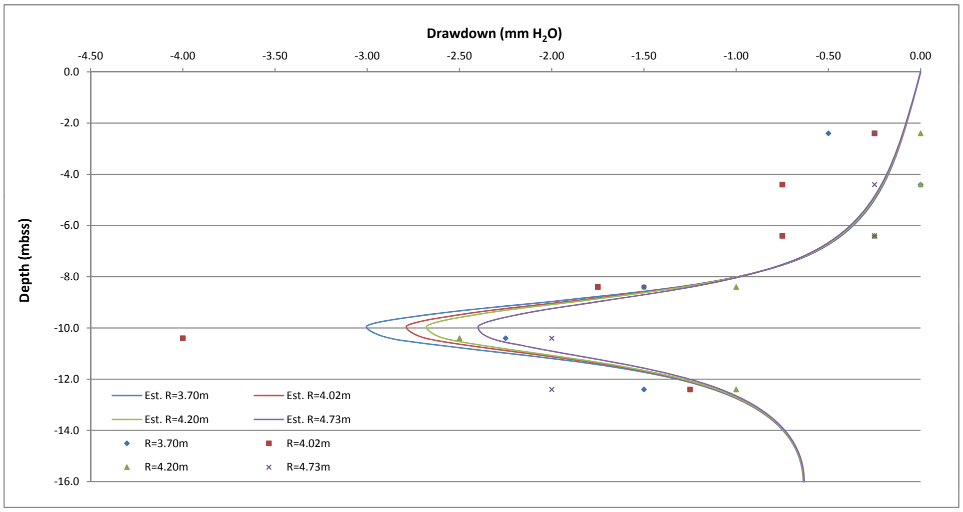
K_{gx} (m/s)	A_{gr} (-)	**KD** (-)
2.50E-04	0.05	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m (mm H_2O)	**CMT 130** R=4.2m (mm H_2O)	**CMT 129** R=4.7m (mm H_2O)	**CMT 128** R=3.7m (mm H_2O)
-2.4	-0.25	0	-0.25	-0.5
-4.4	-0.75	0	-0.25	0
-6.4	-0.75	-0.25	-0.25	-0.25
-8.4	-1.75	-1	-1.5	-1.5
-10.4	-4	-2.5	-2	-2.25
-12.4	-1.25	-1	-2	-1.5
-14.4	0	-0.5	-1.25	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH (mm H_2O)	**CMT 130** R=4.2m TH (mm H_2O)	**CMT 129** R=4.7m TH (mm H_2O)	**CMT 128** R=3.7m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-2.4	-0.09	-0.09	-0.10	-0.09	0.22
-4.4	-0.21	-0.21	-0.21	-0.20	0.38
-6.4	-0.44	-0.44	-0.45	-0.43	0.21
-8.4	-1.30	-1.28	-1.24	-1.32	0.38
-10.4	-2.68	-2.59	-2.33	-2.88	2.24
-12.4	-1.11	-1.11	-1.08	-1.12	1.01
-14.4	-0.70	-0.70	-0.70	-0.70	1.34
				Total	5.78



NOTES:

- i.e. -R=3.7m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test: **150909-A-VERT-1** **FLOW RATE 2**

Client: Syncrude Canada Ltd.

Test Date	15-Sep-09
Test Interval Temperature (^oC)	10.3
Ambient Barometric Pressure (kPa)	100.9
Center of Test Interval (mbss)	10.01
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
7.08E-03	1.07E-02
1.13E-02	1.71E-02
1.60E-02	2.43E-02
1.04E-02	1.57E-02
7.08E-03	1.07E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.71E-05	1.25	999.68

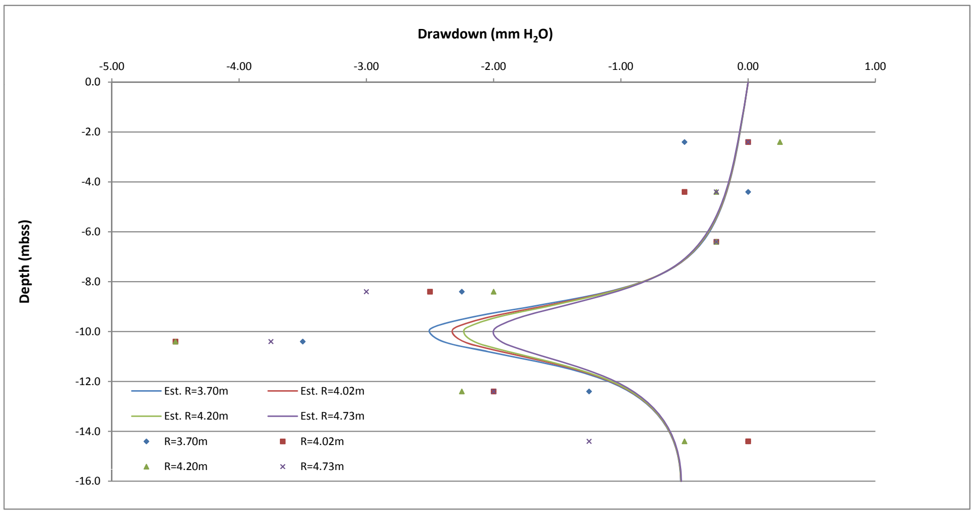
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.50E-04	0.05	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m (mm H_2O)	**CMT 130** R=4.2m (mm H_2O)	**CMT 129** R=4.7m (mm H_2O)	**CMT 128** R=3.7m (mm H_2O)
-2.4	0	0.25	0	-0.5
-4.4	-0.5	-0.25	-0.25	0
-6.4	-0.25	-0.25	-0.25	-0.25
-8.4	-2.5	-2	-3	-2.25
-10.4	-4.5	-4.5	-3.75	-3.5
-12.4	-2	-2.25	-2	-1.25
-14.4	0	-0.5	-1.25	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH (mm H_2O)	**CMT 130** R=4.2m TH (mm H_2O)	**CMT 129** R=4.7m TH (mm H_2O)	**CMT 128** R=3.7m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-2.4	-0.08	-0.08	-0.08	-0.08	0.40
-4.4	-0.17	-0.17	-0.18	-0.17	0.39
-6.4	-0.36	-0.37	-0.37	-0.36	0.05
-8.4	-1.08	-1.07	-1.04	-1.10	0.83
-10.4	-2.24	-2.15	-1.94	-2.40	0.61
-12.4	-0.93	-0.92	-0.90	-0.94	0.28
-14.4	-0.58	-0.58	-0.58	-0.59	0.80
				Total	3.37



NOTES:
- i.e. -R=3.7m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

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Packer Test:	**150909-A-VERT-1**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	15-Sep-09
Test Interval Temperature (^oC)	10.3
Ambient Barometric Pressure (kPa)	100.9
Center of Test Interval (mbss)	10.01
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
7.08E-03	1.07E-02
1.13E-02	1.71E-02
1.60E-02	2.43E-02
1.04E-02	1.57E-02
7.08E-03	1.07E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.71E-05	1.25	999.68

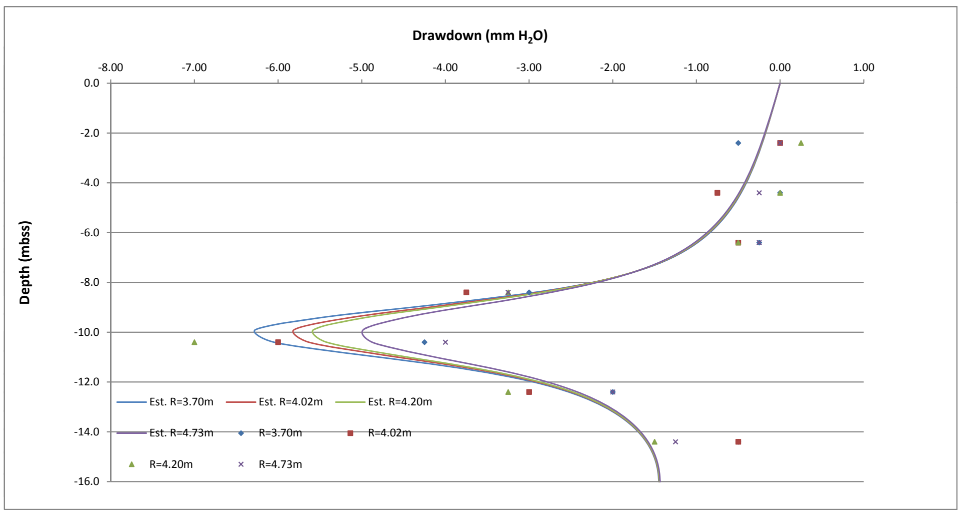
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.50E-04	0.06	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m ($mm\ H_2O$)	**CMT 130** R=4.2m ($mm\ H_2O$)	**CMT 129** R=4.7m ($mm\ H_2O$)	**CMT 128** R=3.7m ($mm\ H_2O$)
-2.4	0	0.25	0	-0.5
-4.4	-0.75	0	-0.25	0
-6.4	-0.5	-0.5	-0.25	-0.25
-8.4	-3.75	-3.25	-3.25	-3
-10.4	-6	-7	-4	-4.25
-12.4	-3	-3.25	-2	-2
-14.4	-0.5	-1.5	-1.25	-0.5

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH ($mm\ H_2O$)	**CMT 130** R=4.2m TH ($mm\ H_2O$)	**CMT 129** R=4.7m TH ($mm\ H_2O$)	**CMT 128** R=3.7m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-2.4	-0.22	-0.22	-0.22	-0.21	0.40
-4.4	-0.48	-0.48	-0.49	-0.47	0.58
-6.4	-1.00	-1.01	-1.02	-0.99	1.64
-8.4	-2.87	-2.84	-2.74	-2.93	1.20
-10.4	-5.63	-5.42	-4.88	-6.05	6.64
-12.4	-2.50	-2.48	-2.42	-2.53	1.31
-14.4	-1.60	-1.59	-1.58	-1.60	2.53
				Total	14.30



NOTES:
- i.e. -R=3.7m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**150909-A-VERT-1**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	15-Sep-09
Test Interval Temperature (^oC)	10.3
Ambient Barometric Pressure (kPa)	100.9
Center of Test Interval (mbss)	10.01
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
7.08E-03	1.07E-02
1.13E-02	1.71E-02
1.60E-02	2.43E-02
1.04E-02	1.57E-02
7.08E-03	1.07E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.71E-05	1.25	999.68

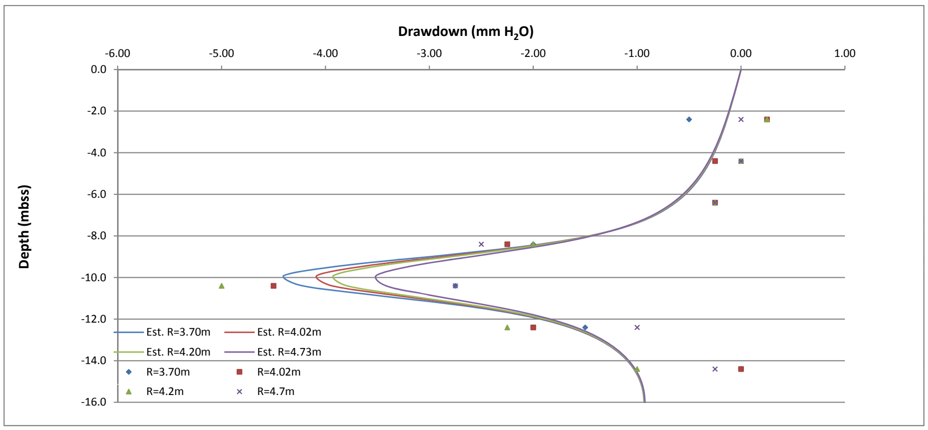
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.50E-04	0.05	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth	**CMT 131**	**CMT 130**	**CMT 129**	**CMT 128**
	R=4.02m	R=4.2m	R=4.7m	R=3.7m
(mbss)	(mm H_2O)	(mm H_2O)	(mm H_2O)	(mm H_2O)
-2.4	0.25	0.25	0	-0.5
-4.4	-0.25	0	0	0
-6.4	-0.25	-0.25	-0.25	-0.25
-8.4	-2.25	-2	-2.5	-2
-10.4	-4.5	-5	-2.75	-2.75
-12.4	-2	-2.25	-1	-1.5
-14.4	0	-1	-0.25	0

Simulated Drawdown at Monitoring Locations

Port Depth	**CMT 131**	**CMT 130**	**CMT 129**	**CMT 128**	**SLS**
	R=4.02m	R=4.2m	R=4.7m	R=3.7m	
(mbss)	TH (mm H_2O)	TH (mm H_2O)	TH (mm H_2O)	TH (mm H_2O)	(mm^2 H_2O)
-2.4	-0.14	-0.14	-0.14	-0.13	0.45
-4.4	-0.30	-0.30	-0.31	-0.30	0.28
-6.4	-0.64	-0.64	-0.65	-0.63	0.61
-8.4	-1.90	-1.88	-1.83	-1.93	0.59
-10.4	-3.94	-3.79	-3.42	-4.22	4.39
-12.4	-1.63	-1.62	-1.59	-1.65	0.90
-14.4	-1.03	-1.03	-1.02	-1.03	2.72
				Total	9.95



NOTES:
- i.e. -R=3.7m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**150909-A-VERT-1**	**FLOW RATE 5**
Client:	Syncrude Canada Ltd.	

Test Date	15-Sep-09
Test Interval Temperature (^oC)	10.3
Ambient Barometric Pressure (kPa)	100.9
Center of Test Interval (mbss)	10.01
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
7.08E-03	1.07E-02
1.13E-02	1.71E-02
1.60E-02	2.43E-02
1.04E-02	1.57E-02
7.08E-03	1.07E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.71E-05	1.25	999.68

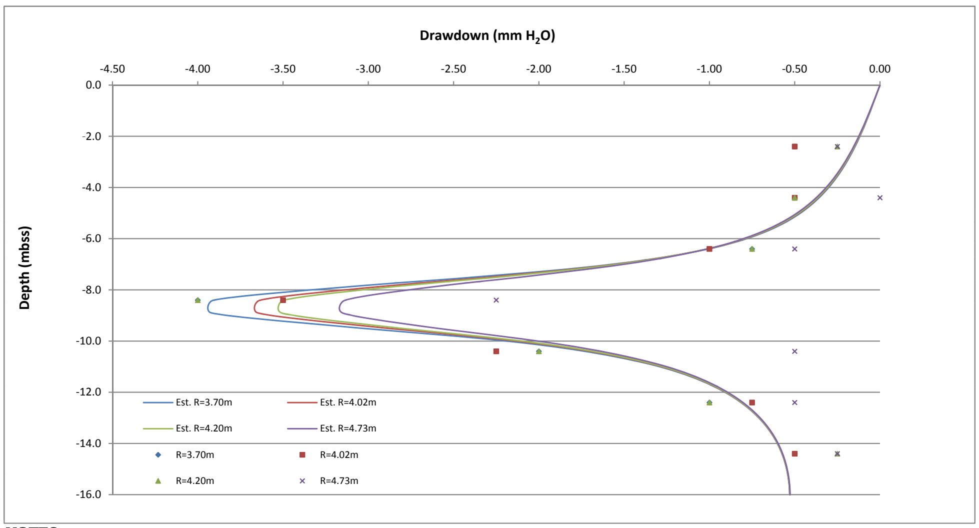
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.50E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 131** R=4.02m ($mm\ H_2O$)	**CMT 130** R=4.2m ($mm\ H_2O$)	**CMT 129** R=4.7m ($mm\ H_2O$)	**CMT 128** R=3.7m ($mm\ H_2O$)
-2.4	-0.5	-0.25	-0.25	-0.5
-4.4	-0.5	-0.5	0	-0.5
-6.4	-1	-0.75	-0.5	-0.75
-8.4	-3.5	-4	-2.25	-4
-10.4	-2.25	-2	-0.5	-2
-12.4	-0.75	-1	-0.5	-1
-14.4	-0.5	-0.25	-0.25	-0.5

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 131** R=4.02m TH ($mm\ H_2O$)	**CMT 130** R=4.2m TH ($mm\ H_2O$)	**CMT 129** R=4.7m TH ($mm\ H_2O$)	**CMT 128** R=3.7m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-2.4	-0.15	-0.15	-0.15	-0.15	0.27
-4.4	-0.36	-0.37	-0.37	-0.36	0.20
-6.4	-1.01	-1.01	-1.01	-1.00	0.39
-8.4	-3.63	-3.49	-3.13	-3.91	1.06
-10.4	-1.70	-1.68	-1.63	-1.73	1.76
-12.4	-0.81	-0.81	-0.80	-0.81	0.17
-14.4	-0.57	-0.57	-0.57	-0.58	0.22
				Total	4.07



NOTES:

- i.e. -R=3.7m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test: **230909-B-VERT-1** **FLOW RATE 1**

Client: Syncrude Canada Ltd.

Test Date	23-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.72E-05	1.21	999.68

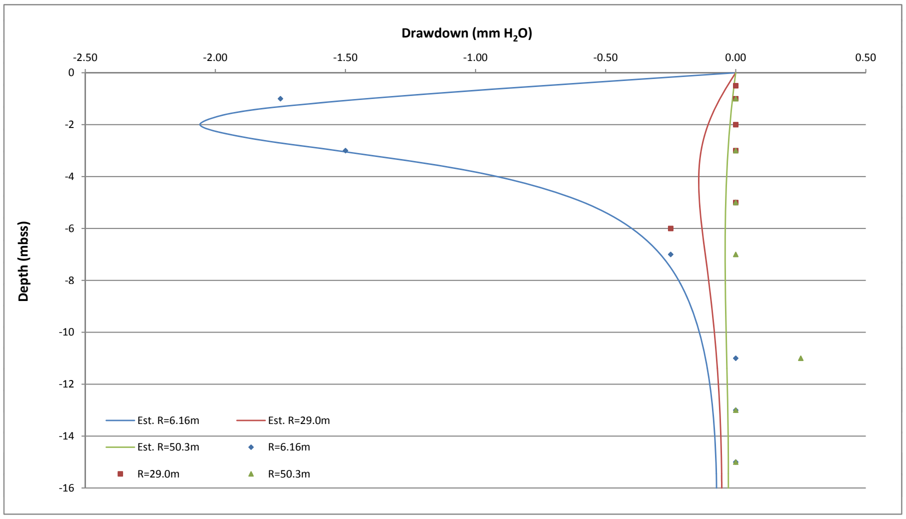
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.75E-04	0.04	1

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m (mm H_2O)	**CMT 147** R=29.0m (mm H_2O)	**CMT 143** R=50.3m (mm H_2O)
-0.5	-	0	-
-1	-1.75	0	0
-2	-	0	-
-3	-1.5	0	0
-5	0	0	0
-6	-	-0.25	-
-7	-0.25	-	0
-11	0	-	0.25
-13	0	-	0
-15	0	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH (mm H_2O)	**CMT 147** R=29.0m TH (mm H_2O)	**CMT 143** R=50.3m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.74	-0.03	-0.01	0.00
-1	-1.42	-0.06	-0.01	0.11
-2	-2.06	-0.11	-0.02	0.01
-3	-1.53	-0.13	-0.03	0.02
-5	-0.58	-0.14	-0.04	0.36
-6	-0.40	-0.13	-0.04	0.01
-7	-0.29	-0.12	-0.04	0.00
-11	-0.12	-0.07	-0.03	0.09
-13	-0.09	-0.06	-0.03	0.01
-15	-0.08	-0.05	-0.03	0.01
			Total	0.63



NOTES:

- i.e. -R=6.16m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**230909-B-VERT-1**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.72E-05	1.21	999.68

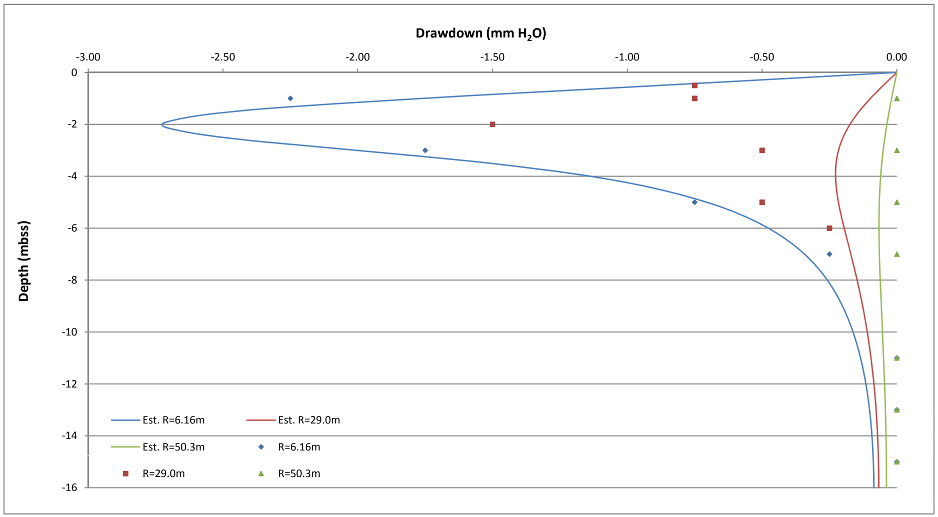
K_{gx} (m/s)	KR (-)	KD (-)
3.50E-04	0.03	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m ($mm\ H_2O$)	**CMT 147** R=29.0m ($mm\ H_2O$)	**CMT 143** R=50.3m ($mm\ H_2O$)
-0.5	-	-0.75	-
-1	-2.25	-0.75	0
-2	-	-1.5	-
-3	-1.75	-0.5	0
-5	-0.75	-0.5	0
-6	-	-0.25	-
-7	-0.25	-	0
-11	0	-	0
-13	0	-	0
-15	0	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH ($mm\ H_2O$)	**CMT 147** R=29.0m TH ($mm\ H_2O$)	**CMT 143** R=50.3m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.88	-0.05	-0.01	0.49
-1	-1.76	-0.10	-0.02	0.67
-2	-2.73	-0.17	-0.04	1.76
-3	-2.00	-0.22	-0.05	0.15
-5	-0.71	-0.22	-0.07	0.09
-6	-0.48	-0.20	-0.07	0.00
-7	-0.34	-0.17	-0.06	0.01
-11	-0.13	-0.10	-0.05	0.02
-13	-0.10	-0.08	-0.04	0.01
-15	-0.09	-0.07	-0.04	0.01
			Total	3.21



NOTES:
- i.e. -R=6.16m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**230909-B-VERT-1**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.72E-05	1.21	999.68

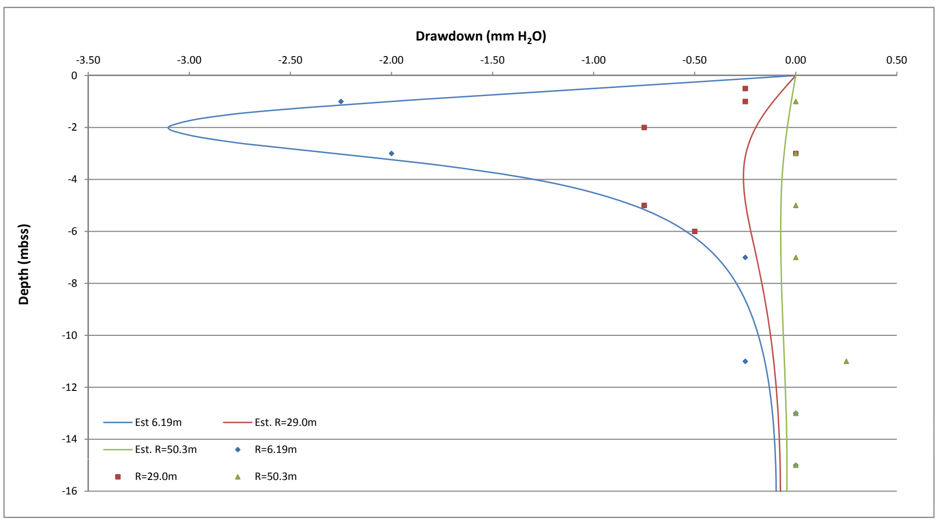
K_{gx} (m/s)	**KR** (-)	**KD** (-)
3.75E-04	0.03	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m (mm H_2O)	**CMT 147** R=29.0m (mm H_2O)	**CMT 143** R=50.3m (mm H_2O)
-0.5	-	-0.25	-
-1	-2.25	-0.25	0
-2	-	-0.75	-
-3	-2	0	0
-5	-0.75	-0.75	0
-6	-	-0.5	-
-7	-0.25	-	0
-11	-0.25	-	0.25
-13	0	-	0
-15	0	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH (mm H_2O)	**CMT 147** R=29.0m TH (mm H_2O)	**CMT 143** R=50.3m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-1.00	-0.06	-0.01	0.04
-1	-2.00	-0.11	-0.02	0.08
-2	-3.10	-0.20	-0.04	0.30
-3	-2.28	-0.25	-0.06	0.14
-5	-0.80	-0.25	-0.07	0.26
-6	-0.54	-0.22	-0.08	0.08
-7	-0.39	-0.19	-0.07	0.03
-11	-0.15	-0.11	-0.06	0.10
-13	-0.12	-0.09	-0.05	0.02
-15	-0.10	-0.08	-0.04	0.01
			Total	1.06



NOTES:
- i.e. -R=6.16m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test: **230909-B-VERT-1** **FLOW RATE 4**

Client: Syncrude Canada Ltd.

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.72E-05	1.21	999.68

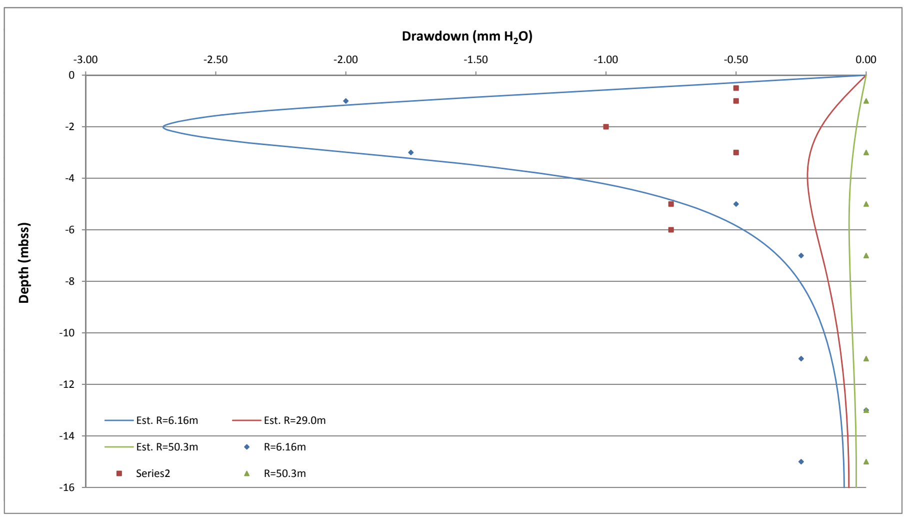
K_{gx} (m/s)	A_{gr} (-)	KD (-)
3.50E-04	0.03	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m ($mm\ H_2O$)	**CMT 147** R=29.0m ($mm\ H_2O$)	**CMT 143** R=50.3m ($mm\ H_2O$)
-0.5	-	-0.5	-
-1	-2	-0.5	0
-2	-	-1	-
-3	-1.75	-0.5	0
-5	-0.5	-0.75	0
-6	-	-0.75	-
-7	-0.25	-	0
-11	-0.25	-	0
-13	0	-	0
-15	-0.25	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH ($mm\ H_2O$)	**CMT 147** R=29.0m TH ($mm\ H_2O$)	**CMT 143** R=50.3m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.87	-0.05	-0.01	0.20
-1	-1.74	-0.10	-0.02	0.23
-2	-2.70	-0.17	-0.04	0.68
-3	-1.99	-0.21	-0.05	0.14
-5	-0.70	-0.21	-0.06	0.33
-6	-0.47	-0.19	-0.07	0.31
-7	-0.34	-0.17	-0.06	0.01
-11	-0.13	-0.10	-0.05	0.02
-13	-0.10	-0.08	-0.04	0.01
-15	-0.09	-0.07	-0.04	0.03
			Total	1.96



NOTES:

- i.e. -R=6.16m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**230909-B-VERT-1**	**FLOW RATE 5**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.72E-05	1.21	999.68

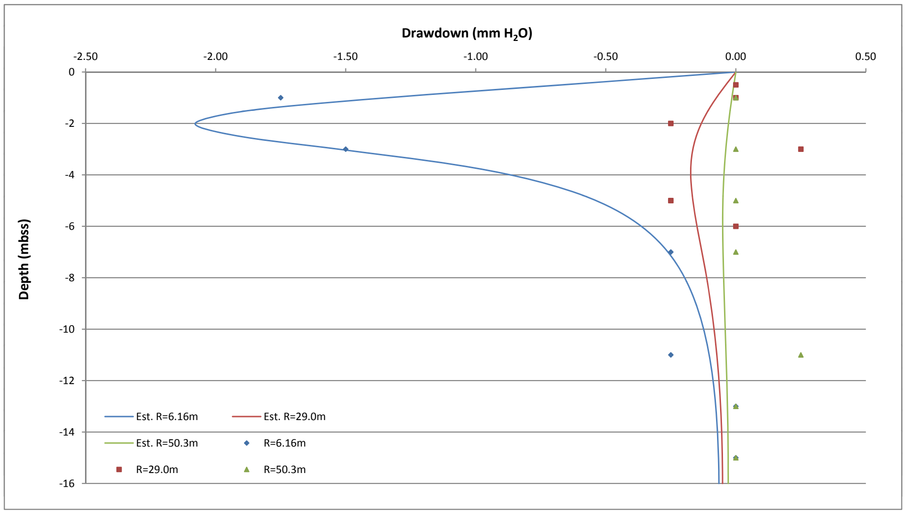
K_{gx} (m/s)	A_{gr} (-)	KD (-)
3.50E-04	0.03	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m ($mm\ H_2O$)	**CMT 147** R=29.0m ($mm\ H_2O$)	**CMT 143** R=50.3m ($mm\ H_2O$)
-0.5	-	0	-
-1	-1.75	0	0
-2	-	-0.25	-
-3	-1.5	0.25	0
-5	-0.25	-0.25	0
-6	-	0	-
-7	-0.25	-	0
-11	-0.25	-	0.25
-13	0	-	0
-15	0	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH ($mm\ H_2O$)	**CMT 147** R=29.0m TH ($mm\ H_2O$)	**CMT 143** R=50.3m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.67	-0.04	-0.01	0.00
-1	-1.34	-0.07	-0.01	0.17
-2	-2.08	-0.13	-0.03	0.01
-3	-1.53	-0.17	-0.04	0.17
-5	-0.54	-0.17	-0.05	0.09
-6	-0.36	-0.15	-0.05	0.02
-7	-0.26	-0.13	-0.05	0.00
-11	-0.10	-0.07	-0.04	0.10
-13	-0.08	-0.06	-0.03	0.01
-15	-0.07	-0.05	-0.03	0.01
			Total	0.60



NOTES:
- i.e. -R=6.16m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	230909-B-VERT-2	FLOW RATE 1
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.72E-05	1.21	999.68

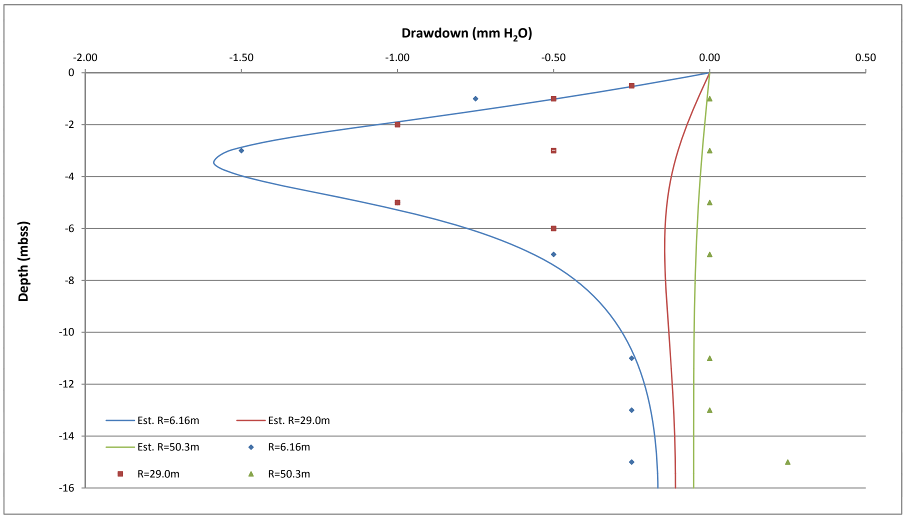
K_{gx} (m/s)	A_{gr} (-)	KD (-)
3.00E-04	0.075	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m ($mm\ H_2O$)	**CMT 147** R=29.0m ($mm\ H_2O$)	**CMT 143** R=50.3m ($mm\ H_2O$)
-0.5	-	-0.25	-
-1	-0.75	-0.5	0
-2	-	-1	-
-3	-1.5	-0.5	0
-5	-1	-1	0
-6	-	-0.5	-
-7	-0.5	-	0
-11	-0.25	-	0
-13	-0.25	-	0
-15	-0.25	-	0.25

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH ($mm\ H_2O$)	**CMT 147** R=29.0m TH ($mm\ H_2O$)	**CMT 143** R=50.3m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.23	-0.02	0.00	0.05
-1	-0.49	-0.04	-0.01	0.28
-2	-1.07	-0.07	-0.02	0.86
-3	-1.54	-0.10	-0.02	0.16
-5	-1.11	-0.14	-0.04	0.76
-6	-0.78	-0.14	-0.04	0.13
-7	-0.56	-0.14	-0.04	0.01
-11	-0.24	-0.13	-0.05	0.00
-13	-0.19	-0.12	-0.05	0.01
-15	-0.17	-0.11	-0.05	0.10
			Total	2.36



NOTES:

- i.e. -R=6.16m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**230909-B-VERT-2**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.72E-05	1.21	999.68

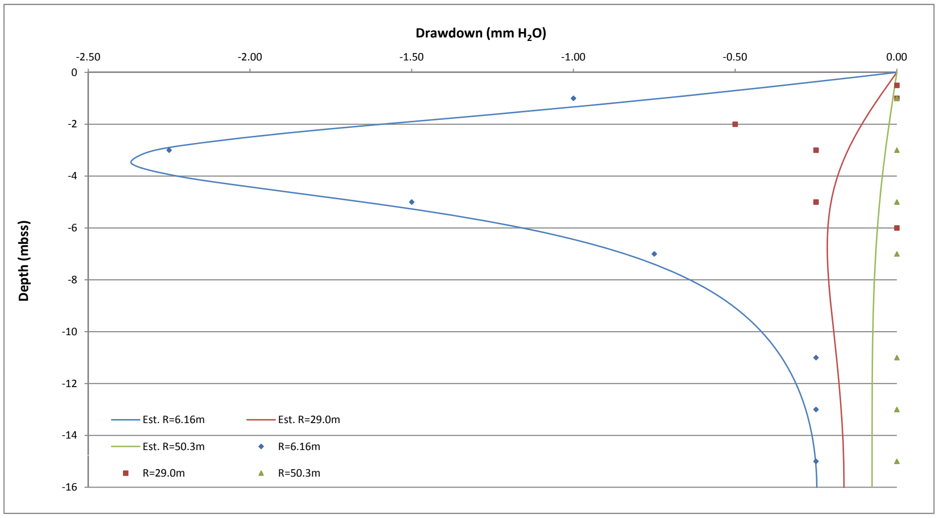
K_{gx} (m/s)	**KR** (-)	**KD** (-)
2.75E-04	0.075	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m (mm H_2O)	**CMT 147** R=29.0m (mm H_2O)	**CMT 143** R=50.3m (mm H_2O)
-0.5	-	0	-
-1	-1	0	0
-2	-	-0.5	-
-3	-2.25	-0.25	0
-5	-1.5	-0.25	0
-6	-	0	-
-7	-0.75	-	0
-11	-0.25	-	0
-13	-0.25	-	0
-15	-0.25	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH (mm H_2O)	**CMT 147** R=29.0m TH (mm H_2O)	**CMT 143** R=50.3m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.35	-0.03	-0.01	0.00
-1	-0.73	-0.06	-0.01	0.08
-2	-1.59	-0.11	-0.02	0.15
-3	-2.29	-0.15	-0.04	0.01
-5	-1.65	-0.20	-0.05	0.03
-6	-1.16	-0.21	-0.06	0.05
-7	-0.84	-0.21	-0.07	0.01
-11	-0.36	-0.19	-0.08	0.02
-13	-0.28	-0.17	-0.08	0.01
-15	-0.25	-0.16	-0.08	0.01
			Total	0.36



NOTES:
- i.e. -R=6.16m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	230909-B-VERT-2	FLOW RATE 3
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	Flux (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.72E-05	1.21	999.68

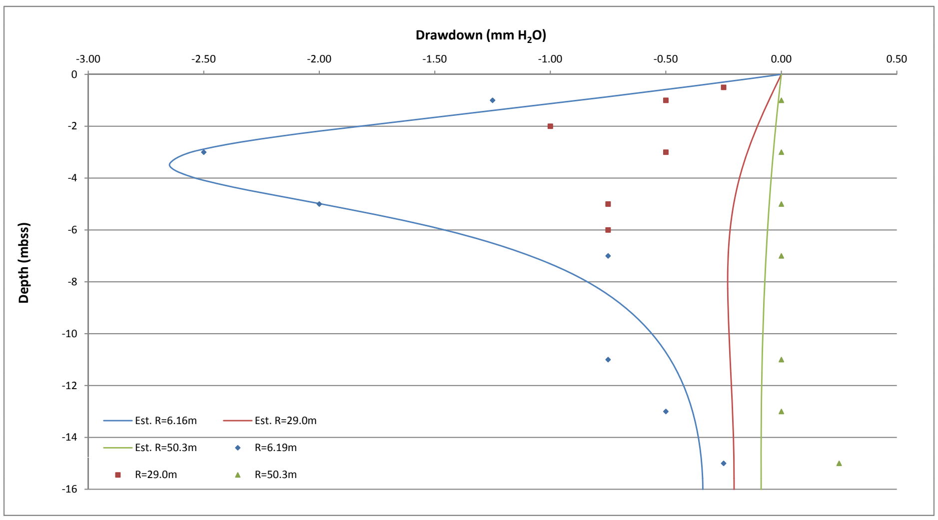
K_{gx} (m/s)	KR (-)	KD (-)
2.50E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	CMT 144 R=6.16m (mm H_2O)	CMT 147 R=29.0m (mm H_2O)	CMT 143 R=50.3m (mm H_2O)
-0.5	-	-0.25	-
-1	-1.25	-0.5	0
-2	-	-1	-
-3	-2.5	-0.5	0
-5	-2	-0.75	0
-6	-	-0.75	-
-7	-0.75	-	0
-11	-0.75	-	0
-13	-0.5	-	0
-15	-0.25	-	0.25

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	CMT 144 R=6.16m TH (mm H_2O)	CMT 147 R=29.0m TH (mm H_2O)	CMT 143 R=50.3m TH (mm H_2O)	SLS (mm^2 H_2O)
-0.5	-0.43	-0.03	-0.01	0.05
-1	-0.87	-0.05	-0.01	0.34
-2	-1.83	-0.10	-0.02	0.80
-3	-2.55	-0.15	-0.03	0.13
-5	-1.99	-0.21	-0.05	0.30
-6	-1.46	-0.22	-0.06	0.28
-7	-1.09	-0.23	-0.07	0.12
-11	-0.48	-0.22	-0.08	0.08
-13	-0.38	-0.21	-0.09	0.02
-15	-0.34	-0.21	-0.09	0.12
			Total	2.24



NOTES:
- i.e. -R=6.16m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**230909-B-VERT-2**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.72E-05	1.21	999.68

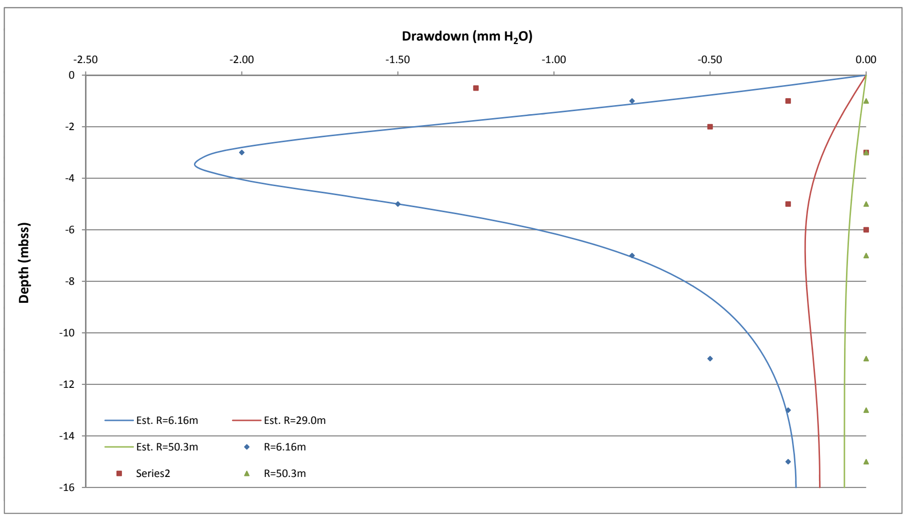
K_{gx} (m/s)	A_{gr} (-)	KD (-)
3.00E-04	0.075	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m ($mm\ H_2O$)	**CMT 147** R=29.0m ($mm\ H_2O$)	**CMT 143** R=50.3m ($mm\ H_2O$)
-0.5	-	-1.25	-
-1	-0.75	-0.25	0
-2	-	-0.5	-
-3	-2	0	0
-5	-1.5	-0.25	0
-6	-	0	-
-7	-0.75	-	0
-11	-0.5	-	0
-13	-0.25	-	0
-15	-0.25	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH ($mm\ H_2O$)	**CMT 147** R=29.0m TH ($mm\ H_2O$)	**CMT 143** R=50.3m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.32	-0.03	-0.01	1.50
-1	-0.66	-0.05	-0.01	0.05
-2	-1.44	-0.10	-0.02	0.16
-3	-2.08	-0.14	-0.03	0.03
-5	-1.50	-0.18	-0.05	0.01
-6	-1.05	-0.19	-0.05	0.04
-7	-0.76	-0.20	-0.06	0.00
-11	-0.32	-0.17	-0.07	0.04
-13	-0.26	-0.16	-0.07	0.00
-15	-0.23	-0.15	-0.07	0.01
			Total	1.83



NOTES:
- i.e. -R=6.16m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	230909-B-VERT-2	FLOW RATE 5
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	Flux (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.72E-05	1.21	999.68

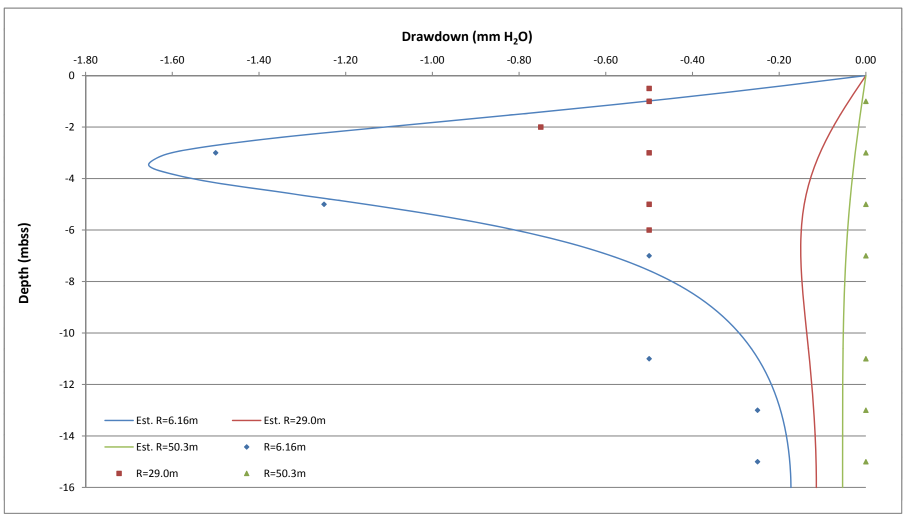
K_{gx} (m/s)	A_{gr} (-)	KD (-)
3.00E-04	0.075	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	CMT 144 R=6.16m ($mm H_2O$)	CMT 147 R=29.0m ($mm H_2O$)	CMT 143 R=50.3m ($mm H_2O$)
-0.5	-	-0.5	-
-1	-0.5	-0.5	0
-2	-	-0.75	-
-3	-1.5	-0.5	0
-5	-1.25	-0.5	0
-6	-	-0.5	-
-7	-0.5	-	0
-11	-0.5	-	0
-13	-0.25	-	0
-15	-0.25	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	CMT 144 R=6.16m TH ($mm H_2O$)	CMT 147 R=29.0m TH ($mm H_2O$)	CMT 143 R=50.3m TH ($mm H_2O$)	SLS ($mm^2 H_2O$)
-0.5	-0.24	-0.02	0.00	0.23
-1	-0.51	-0.04	-0.01	0.21
-2	-1.11	-0.08	-0.02	0.45
-3	-1.60	-0.11	-0.02	0.17
-5	-1.15	-0.14	-0.04	0.14
-6	-0.81	-0.15	-0.04	0.12
-7	-0.59	-0.15	-0.05	0.01
-11	-0.25	-0.13	-0.05	0.07
-13	-0.20	-0.12	-0.05	0.01
-15	-0.18	-0.11	-0.05	0.01
			Total	1.42



NOTES:

- i.e. -R=6.16m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**230909-B-VERT-3**	**FLOW RATE 1**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.18E-02	1.79E-02
1.53E-02	2.32E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.13E-02	1.71E-02

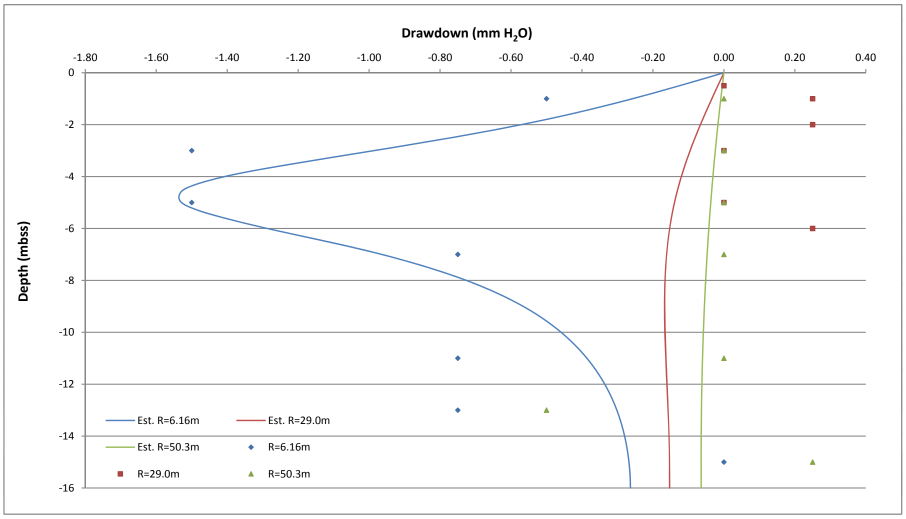
μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68
K_{gx} (m/s)	**A_{gr}** (-)	**KD** (-)
3.00E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m ($mm\ H_2O$)	**CMT 147** R=29.0m ($mm\ H_2O$)	**CMT 143** R=50.3m ($mm\ H_2O$)
-0.5	-	0	-
-1	-0.5	0.25	0
-2	-	0.25	-
-3	-1.5	0	0
-5	-1.5	0	0
-6	-	0.25	-
-7	-0.75	-	0
-11	-0.75	-	0
-13	-0.75	-	-0.5
-15	0	-	0.25

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH ($mm\ H_2O$)	**CMT 147** R=29.0m TH ($mm\ H_2O$)	**CMT 143** R=50.3m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.13	-0.02	0.00	0.00
-1	-0.26	-0.03	-0.01	0.14
-2	-0.57	-0.07	-0.02	0.10
-3	-0.99	-0.10	-0.02	0.27
-5	-1.53	-0.14	-0.04	0.02
-6	-1.29	-0.15	-0.04	0.16
-7	-0.97	-0.16	-0.05	0.05
-11	-0.39	-0.16	-0.06	0.14
-13	-0.30	-0.16	-0.06	0.39
-15	-0.27	-0.15	-0.06	0.17
			Total	1.45



NOTES:
- i.e. -R=6.16m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**230909-B-VERT-3**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

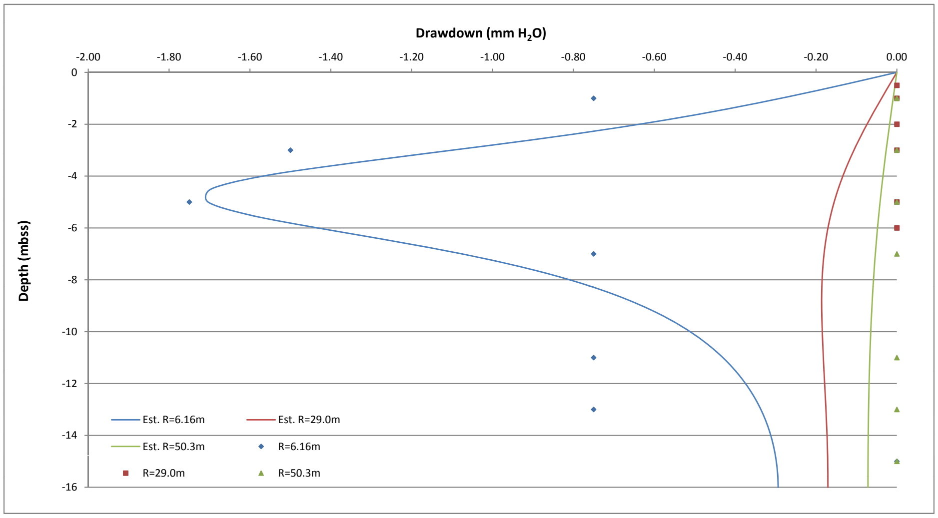
K_{gx} (m/s)	**KR** (-)	**KD** (-)
3.50E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m ($mm\ H_2O$)	**CMT 147** R=29.0m ($mm\ H_2O$)	**CMT 143** R=50.3m ($mm\ H_2O$)
-0.5	-	0	-
-1	-0.75	0	0
-2	-	0	-
-3	-1.5	0	0
-5	-1.75	0	0
-6	-	0	-
-7	-0.75	-	0
-11	-0.75	-	0
-13	-0.75	-	0
-15	0	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH ($mm\ H_2O$)	**CMT 147** R=29.0m TH ($mm\ H_2O$)	**CMT 143** R=50.3m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.14	-0.02	0.00	0.00
-1	-0.29	-0.04	-0.01	0.22
-2	-0.64	-0.07	-0.02	0.01
-3	-1.10	-0.11	-0.03	0.17
-5	-1.70	-0.16	-0.04	0.03
-6	-1.43	-0.17	-0.05	0.03
-7	-1.08	-0.18	-0.05	0.11
-11	-0.43	-0.18	-0.07	0.11
-13	-0.34	-0.18	-0.07	0.18
-15	-0.30	-0.17	-0.07	0.09
			Total	0.94



NOTES:
- i.e. -R=6.16m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**230909-B-VERT-3**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.18E-02	1.79E-02
1.53E-02	2.32E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.13E-02	1.71E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

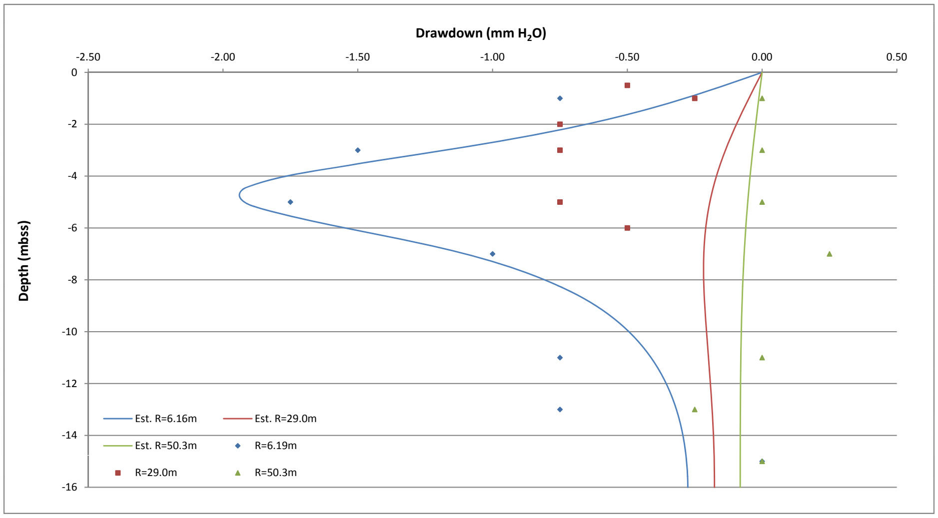
K_{gx} (m/s)	**KR** (-)	**KD** (-)
4.50E-04	0.075	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m ($mm\ H_2O$)	**CMT 147** R=29.0m ($mm\ H_2O$)	**CMT 143** R=50.3m ($mm\ H_2O$)
-0.5	-	-0.5	-
-1	-0.75	-0.25	0
-2	-	-0.75	-
-3	-1.5	-0.75	0
-5	-1.75	-0.75	0
-6	-	-0.5	-
-7	-1	-	0.25
-11	-0.75	-	0
-13	-0.75	-	-0.25
-15	0	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH ($mm\ H_2O$)	**CMT 147** R=29.0m TH ($mm\ H_2O$)	**CMT 143** R=50.3m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.14	-0.02	-0.01	0.23
-1	-0.29	-0.05	-0.01	0.26
-2	-0.65	-0.10	-0.02	0.43
-3	-1.18	-0.14	-0.03	0.48
-5	-1.92	-0.19	-0.05	0.34
-6	-1.54	-0.21	-0.06	0.08
-7	-1.10	-0.22	-0.07	0.11
-11	-0.41	-0.20	-0.08	0.12
-13	-0.32	-0.19	-0.08	0.22
-15	-0.28	-0.18	-0.08	0.08
			Total	2.35



NOTES:

- i.e. -R=6.16m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test: **230909-B-VERT-3** **FLOW RATE 4**

Client: Syncrude Canada Ltd.

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.18E-02	1.79E-02
1.53E-02	2.32E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.13E-02	1.71E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

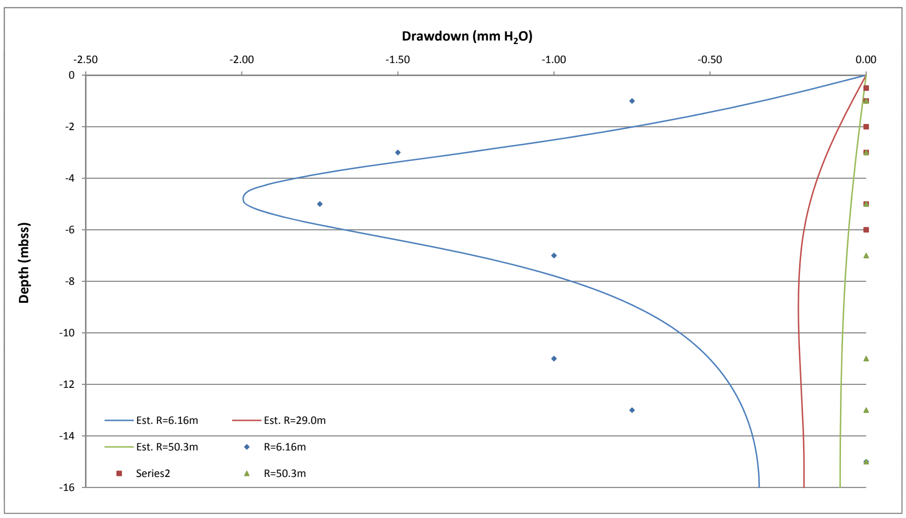
K_{gx} (m/s)	A_{gr} (-)	KD (-)
3.00E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m (mm H_2O)	**CMT 147** R=29.0m (mm H_2O)	**CMT 143** R=50.3m (mm H_2O)
-0.5	-	0	-
-1	-0.75	0	0
-2	-	0	-
-3	-1.5	0	0
-5	-1.75	0	0
-6	-	0	-
-7	-1	-	0
-11	-1	-	0
-13	-0.75	-	0
-15	0	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH (mm H_2O)	**CMT 147** R=29.0m TH (mm H_2O)	**CMT 143** R=50.3m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.16	-0.02	-0.01	0.00
-1	-0.33	-0.04	-0.01	0.17
-2	-0.74	-0.09	-0.02	0.01
-3	-1.28	-0.12	-0.03	0.06
-5	-1.99	-0.18	-0.05	0.09
-6	-1.67	-0.20	-0.06	0.04
-7	-1.26	-0.21	-0.06	0.07
-11	-0.50	-0.21	-0.08	0.25
-13	-0.39	-0.20	-0.08	0.13
-15	-0.35	-0.20	-0.08	0.13
			Total	0.96



NOTES:

- i.e. -R=6.16m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

University of Saskatchewan

Packer Test:	**230909-B-VERT-3**	**FLOW RATE 5**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.18E-02	1.79E-02
1.53E-02	2.32E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.13E-02	1.71E-02

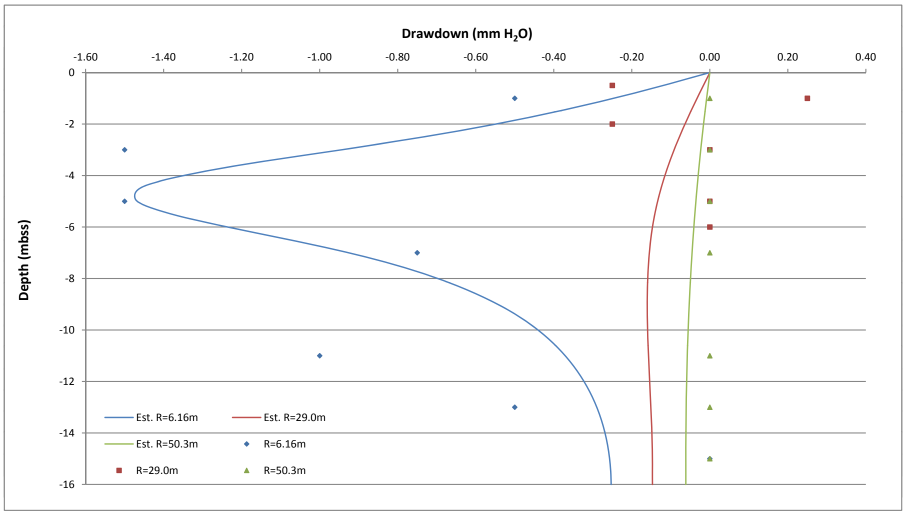
μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68
K_{gx} (m/s)	**A_{gr}** (-)	**KD** (-)
3.00E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m (mm H_2O)	**CMT 147** R=29.0m (mm H_2O)	**CMT 143** R=50.3m (mm H_2O)
-0.5	-	-0.25	-
-1	-0.5	0.25	0
-2	-	-0.25	-
-3	-1.5	0	0
-5	-1.5	0	0
-6	-	0	-
-7	-0.75	-	0
-11	-1	-	0
-13	-0.5	-	0
-15	0	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH (mm H_2O)	**CMT 147** R=29.0m TH (mm H_2O)	**CMT 143** R=50.3m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.12	-0.02	0.00	0.05
-1	-0.25	-0.03	-0.01	0.14
-2	-0.55	-0.06	-0.02	0.03
-3	-0.95	-0.09	-0.02	0.32
-5	-1.47	-0.13	-0.04	0.02
-6	-1.23	-0.15	-0.04	0.02
-7	-0.93	-0.16	-0.05	0.03
-11	-0.37	-0.16	-0.06	0.40
-13	-0.29	-0.15	-0.06	0.05
-15	-0.26	-0.15	-0.06	0.07
			Total	1.14



NOTES:

- i.e. -R=6.16m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

UNIVERSITY OF SASKATCHEWAN

Packer Test:	**230909-B-VERT-4**	**FLOW RATE 1**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.65E-02	2.50E-02
1.77E-02	2.68E-02
1.89E-02	2.86E-02
1.65E-02	2.50E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

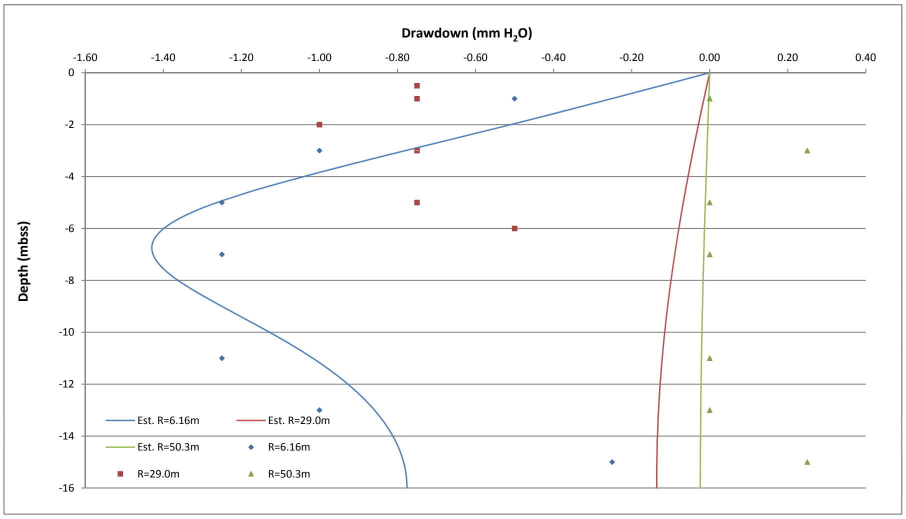
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.75E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m ($mm\ H_2O$)	**CMT 147** R=29.0m ($mm\ H_2O$)	**CMT 143** R=50.3m ($mm\ H_2O$)
-0.5	-	-0.75	-
-1	-0.5	-0.75	0
-2	-	-1	-
-3	-1	-0.75	0.25
-5	-1.25	-0.75	0
-6	-	-0.5	-
-7	-1.25	-	0
-11	-1.25	-	0
-13	-1	-	0
-15	-0.25	-	0.25

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH ($mm\ H_2O$)	**CMT 147** R=29.0m TH ($mm\ H_2O$)	**CMT 143** R=50.3m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.13	-0.01	0.00	0.55
-1	-0.25	-0.01	0.00	0.60
-2	-0.51	-0.03	0.00	0.94
-3	-0.78	-0.04	-0.01	0.62
-5	-1.26	-0.07	-0.01	0.47
-6	-1.40	-0.08	-0.01	0.18
-7	-1.43	-0.09	-0.02	0.03
-11	-1.02	-0.12	-0.02	0.05
-13	-0.86	-0.13	-0.02	0.02
-15	-0.78	-0.14	-0.02	0.36
			Total	3.83



NOTES:

- i.e. -R=6.16m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**230909-B-VERT-4**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

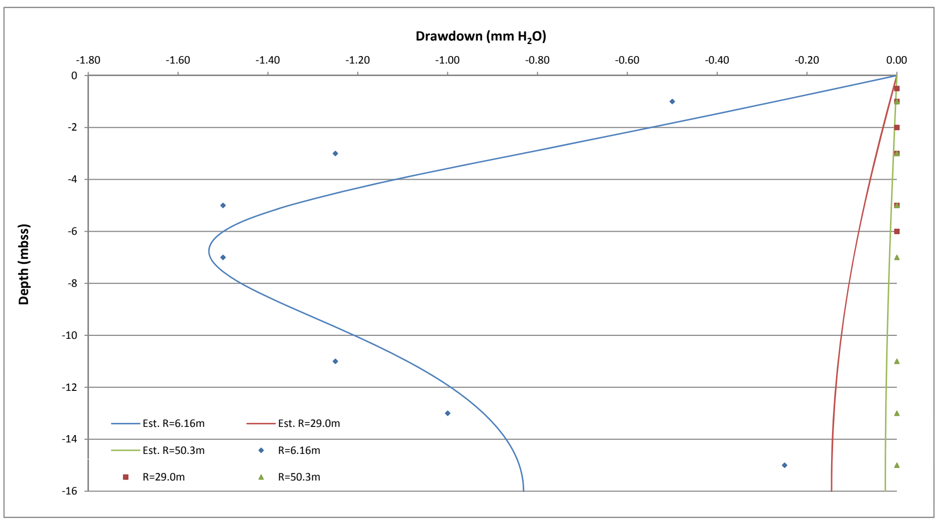
K_{gx} (m/s)	**KR** (-)	**KD** (-)
1.75E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m (mm H_2O)	**CMT 147** R=29.0m (mm H_2O)	**CMT 143** R=50.3m (mm H_2O)
-0.5	-	0	-
-1	-0.5	0	0
-2	-	0	-
-3	-1.25	0	0
-5	-1.5	0	0
-6	-	0	-
-7	-1.5	-	0
-11	-1.25	-	0
-13	-1	-	0
-15	-0.25	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH (mm H_2O)	**CMT 147** R=29.0m TH (mm H_2O)	**CMT 143** R=50.3m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.13	-0.01	0.00	0.00
-1	-0.27	-0.02	0.00	0.05
-2	-0.55	-0.03	-0.01	0.00
-3	-0.83	-0.05	-0.01	0.17
-5	-1.35	-0.07	-0.01	0.03
-6	-1.50	-0.08	-0.01	0.01
-7	-1.53	-0.10	-0.02	0.00
-11	-1.09	-0.13	-0.02	0.03
-13	-0.92	-0.14	-0.02	0.01
-15	-0.84	-0.14	-0.03	0.35
			Total	0.65



NOTES:

- i.e. -R=6.16m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**230909-B-VERT-4**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.65E-02	2.50E-02
1.77E-02	2.68E-02
1.89E-02	2.86E-02
1.65E-02	2.50E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

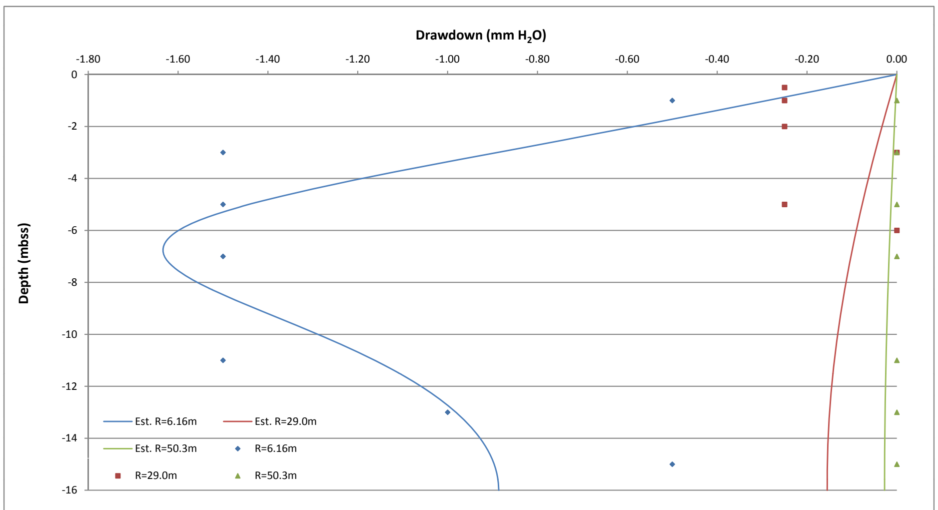
K_{gx} (m/s)	**KR** (-)	**KD** (-)
1.75E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m (mm H_2O)	**CMT 147** R=29.0m (mm H_2O)	**CMT 143** R=50.3m (mm H_2O)
-0.5	-	-0.25	-
-1	-0.5	-0.25	0
-2	-	-0.25	-
-3	-1.5	0	0
-5	-1.5	-0.25	0
-6	-	0	-
-7	-1.5	-	0
-11	-1.5	-	0
-13	-1	-	0
-15	-0.5	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH (mm H_2O)	**CMT 147** R=29.0m TH (mm H_2O)	**CMT 143** R=50.3m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.14	-0.01	0.00	0.06
-1	-0.29	-0.02	0.00	0.10
-2	-0.58	-0.03	-0.01	0.05
-3	-0.89	-0.05	-0.01	0.37
-5	-1.44	-0.08	-0.01	0.03
-6	-1.60	-0.09	-0.02	0.01
-7	-1.63	-0.10	-0.02	0.02
-11	-1.16	-0.14	-0.02	0.11
-13	-0.98	-0.15	-0.03	0.00
-15	-0.90	-0.15	-0.03	0.16
			Total	0.91



NOTES:
- i.e. -R=6.16m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**230909-B-VERT-4**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.65E-02	2.50E-02
1.77E-02	2.68E-02
1.89E-02	2.86E-02
1.65E-02	2.50E-02
1.18E-02	1.79E-02

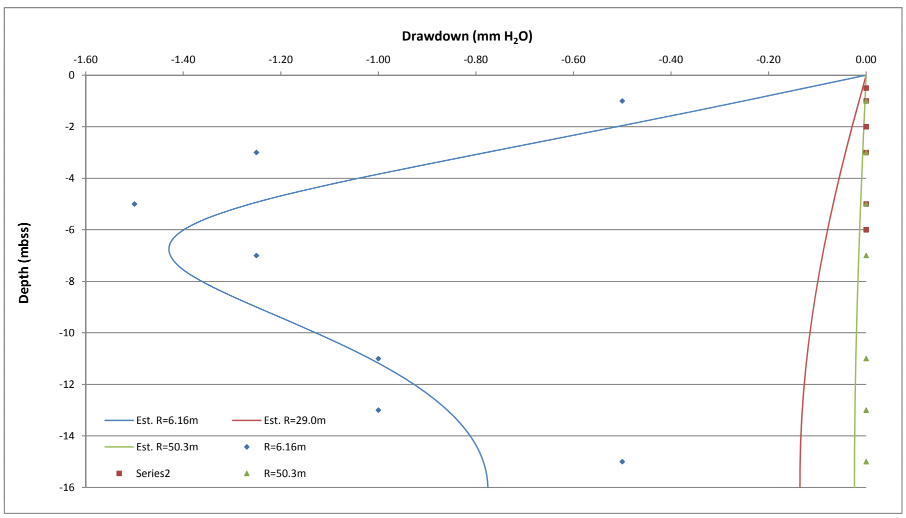
μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68
K_{gx} (m/s)	**A_{gr}** (-)	**KD** (-)
1.75E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m ($mm\ H_2O$)	**CMT 147** R=29.0m ($mm\ H_2O$)	**CMT 143** R=50.3m ($mm\ H_2O$)
-0.5	-	0	-
-1	-0.5	0	0
-2	-	0	-
-3	-1.25	0	0
-5	-1.5	0	0
-6	-	0	-
-7	-1.25	-	0
-11	-1	-	0
-13	-1	-	0
-15	-0.5	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH ($mm\ H_2O$)	**CMT 147** R=29.0m TH ($mm\ H_2O$)	**CMT 143** R=50.3m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.13	-0.01	0.00	0.00
-1	-0.25	-0.01	0.00	0.06
-2	-0.51	-0.03	0.00	0.00
-3	-0.78	-0.04	-0.01	0.22
-5	-1.26	-0.07	-0.01	0.06
-6	-1.40	-0.08	-0.01	0.01
-7	-1.43	-0.09	-0.02	0.03
-11	-1.02	-0.12	-0.02	0.00
-13	-0.86	-0.13	-0.02	0.02
-15	-0.78	-0.14	-0.02	0.08
			Total	0.49



NOTES:
- i.e. -R=6.16m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**230909-B-VERT-4**	**FLOW RATE 5**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.65E-02	2.50E-02
1.77E-02	2.68E-02
1.89E-02	2.86E-02
1.65E-02	2.50E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

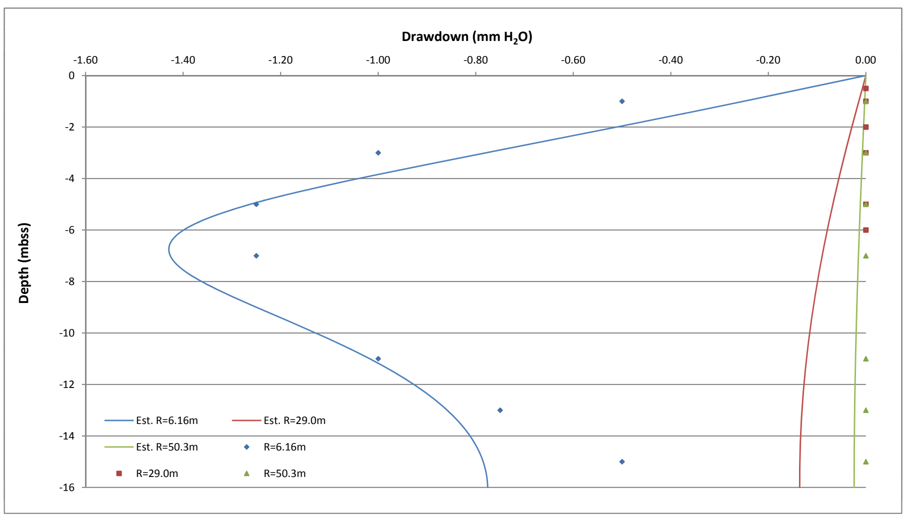
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.25E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m ($mm\ H_2O$)	**CMT 147** R=29.0m ($mm\ H_2O$)	**CMT 143** R=50.3m ($mm\ H_2O$)
-0.5	-	0	-
-1	-0.5	0	0
-2	-	0	-
-3	-1	0	0
-5	-1.25	0	0
-6	-	0	-
-7	-1.25	-	0
-11	-1	-	0
-13	-0.75	-	0
-15	-0.5	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH ($mm\ H_2O$)	**CMT 147** R=29.0m TH ($mm\ H_2O$)	**CMT 143** R=50.3m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.13	-0.01	0.00	0.00
-1	-0.25	-0.01	0.00	0.06
-2	-0.51	-0.03	0.00	0.00
-3	-0.78	-0.04	-0.01	0.05
-5	-1.26	-0.07	-0.01	0.00
-6	-1.40	-0.08	-0.01	0.01
-7	-1.43	-0.09	-0.02	0.03
-11	-1.02	-0.12	-0.02	0.00
-13	-0.86	-0.13	-0.02	0.01
-15	-0.78	-0.14	-0.02	0.08
			Total	0.25



NOTES:
- i.e. -R=6.16m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**230909-B-VERT-5**	**FLOW RATE 1**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.67E-03	1.46E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.51E-02	2.29E-02
9.56E-03	1.45E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

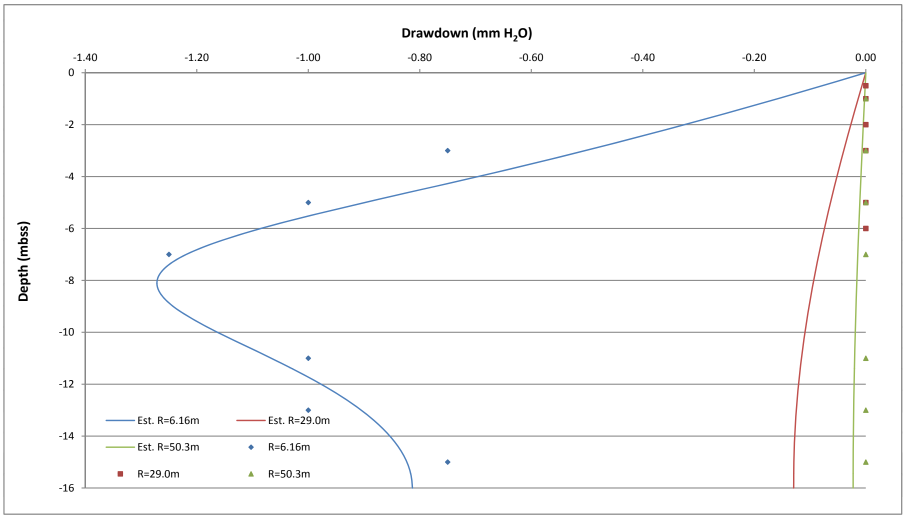
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.26E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m (mm H_2O)	**CMT 147** R=29.0m (mm H_2O)	**CMT 143** R=50.3m (mm H_2O)
-0.5	-	0	-
-1	0	0	0
-2	-	0	-
-3	-0.75	0	0
-5	-1	0	0
-6	-	0	-
-7	-1.25	-	0
-11	-1	-	0
-13	-1	-	0
-15	-0.75	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH (mm H_2O)	**CMT 147** R=29.0m TH (mm H_2O)	**CMT 143** R=50.3m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.08	-0.01	0.00	0.00
-1	-0.16	-0.01	0.00	0.03
-2	-0.32	-0.03	0.00	0.00
-3	-0.50	-0.04	-0.01	0.06
-5	-0.90	-0.06	-0.01	0.01
-6	-1.08	-0.07	-0.01	0.01
-7	-1.22	-0.08	-0.01	0.00
-11	-1.07	-0.12	-0.02	0.00
-13	-0.91	-0.12	-0.02	0.01
-15	-0.82	-0.13	-0.02	0.01
			Total	0.13



NOTES:
- i.e. -R=6.16m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**230909-B-VERT-5**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

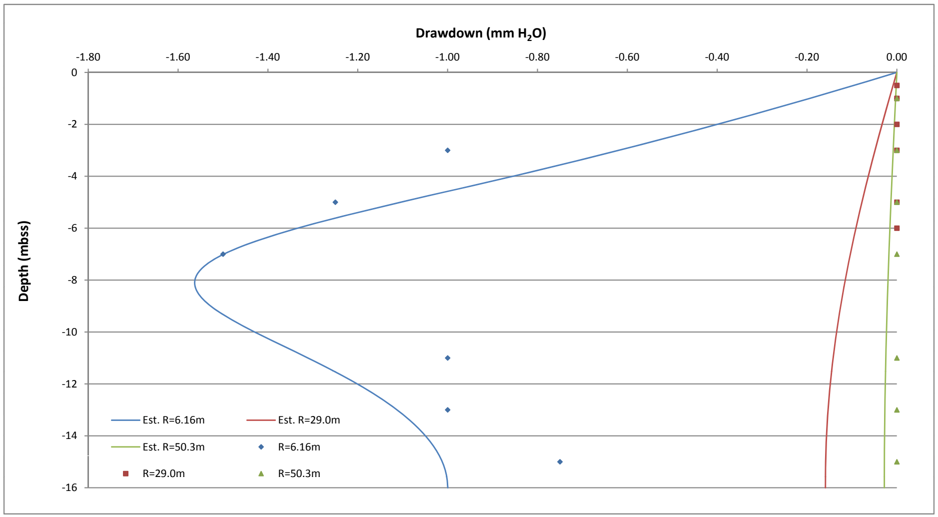
K_{gx} (m/s)	KR (-)	KD (-)
1.50E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m (mm H_2O)	**CMT 147** R=29.0m (mm H_2O)	**CMT 143** R=50.3m (mm H_2O)
-0.5	-	0	-
-1	0	0	0
-2	-	0	-
-3	-1	0	0
-5	-1.25	0	0
-6	-	0	-
-7	-1.5	-	0
-11	-1	-	0
-13	-1	-	0
-15	-0.75	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH (mm H_2O)	**CMT 147** R=29.0m TH (mm H_2O)	**CMT 143** R=50.3m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.10	-0.01	0.00	0.00
-1	-0.19	-0.02	0.00	0.04
-2	-0.40	-0.03	-0.01	0.00
-3	-0.62	-0.05	-0.01	0.15
-5	-1.10	-0.08	-0.01	0.03
-6	-1.33	-0.09	-0.02	0.01
-7	-1.50	-0.10	-0.02	0.00
-11	-1.31	-0.14	-0.02	0.10
-13	-1.11	-0.15	-0.03	0.01
-15	-1.01	-0.16	-0.03	0.07
			Total	0.40



NOTES:
- i.e. -R=6.16m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

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Packer Test: **230909-B-VERT-5** **FLOW RATE 3**

Client: Syncrude Canada Ltd.

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	Flux (m/s)
9.67E-03	1.46E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.51E-02	2.29E-02
9.56E-03	1.45E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

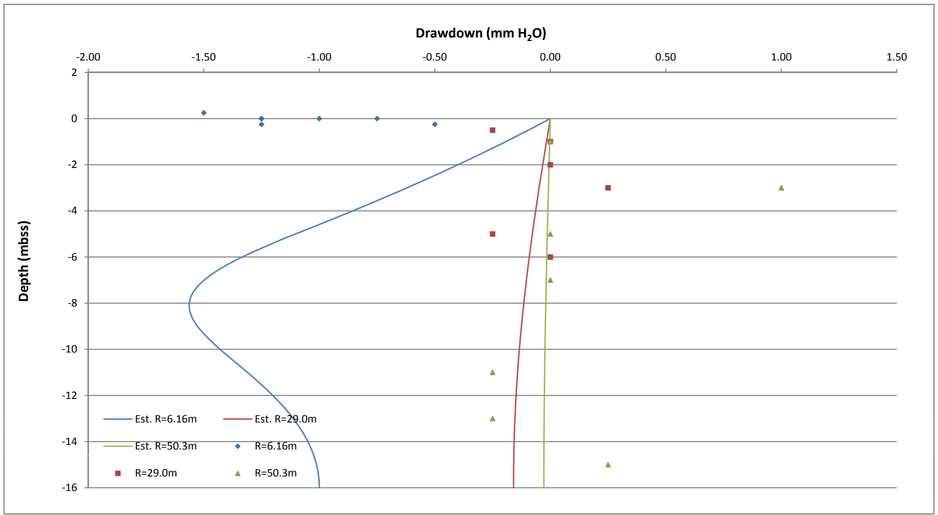
K_{gx} (m/s)	KR (-)	KD (-)
2.00E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	CMT 144 R=6.16m (mm H_2O)	CMT 147 R=29.0m (mm H_2O)	CMT 143 R=50.3m (mm H_2O)
-0.5	-	-0.25	-
-1	-0.5	0	0
-2	-	0	-
-3	-1	0.25	1
-5	-1.25	-0.25	0
-6	-	0	-
-7	-1.5	-	0
-11	-1.25	-	-0.25
-13	-1.25	-	-0.25
-15	-0.75	-	0.25

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	CMT 144 R=6.16m TH (mm H_2O)	CMT 147 R=29.0m TH (mm H_2O)	CMT 143 R=50.3m TH (mm H_2O)	SLS (mm^2 H_2O)
-0.5	-0.10	-0.01	0.00	0.06
-1	-0.19	-0.02	0.00	0.09
-2	-0.40	-0.03	-0.01	0.00
-3	-0.62	-0.05	-0.01	1.25
-5	-1.10	-0.08	-0.01	0.05
-6	-1.33	-0.09	-0.02	0.01
-7	-1.50	-0.10	-0.02	0.00
-11	-1.31	-0.14	-0.02	0.05
-13	-1.11	-0.15	-0.03	0.07
-15	-1.01	-0.16	-0.03	0.15
			Total	1.73



NOTES:

- i.e. -R=6.16m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**230909-B-VERT-5**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.67E-03	1.46E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.51E-02	2.29E-02
9.56E-03	1.45E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

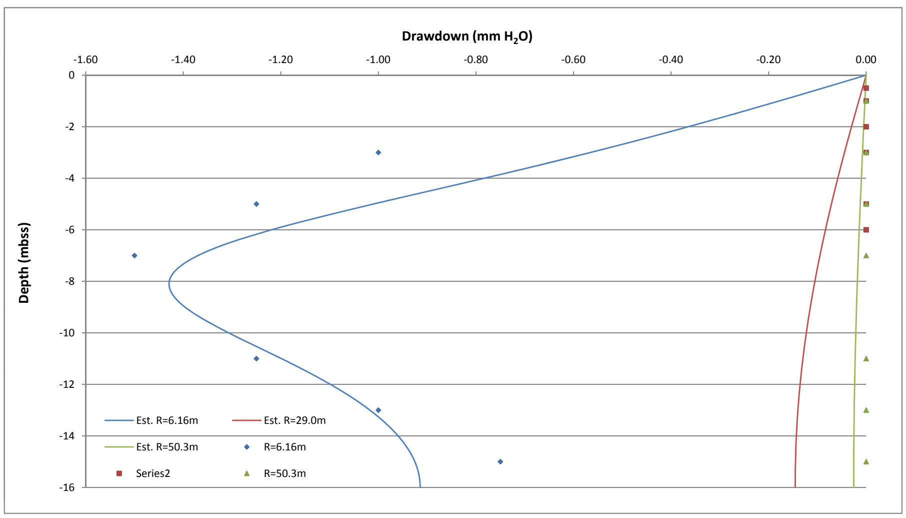
K_{gx} (m/s)	**A_{gr}** (-)	**KD** (-)
1.75E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m ($mm\ H_2O$)	**CMT 147** R=29.0m ($mm\ H_2O$)	**CMT 143** R=50.3m ($mm\ H_2O$)
-0.5	-	0	-
-1	0	0	0
-2	-	0	-
-3	-1	0	0
-5	-1.25	0	0
-6	-	0	-
-7	-1.5	-	0
-11	-1.25	-	0
-13	-1	-	0
-15	-0.75	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH ($mm\ H_2O$)	**CMT 147** R=29.0m TH ($mm\ H_2O$)	**CMT 143** R=50.3m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.09	-0.01	0.00	0.00
-1	-0.18	-0.01	0.00	0.03
-2	-0.36	-0.03	0.00	0.00
-3	-0.57	-0.04	-0.01	0.19
-5	-1.01	-0.07	-0.01	0.06
-6	-1.22	-0.08	-0.01	0.01
-7	-1.37	-0.09	-0.02	0.02
-11	-1.20	-0.13	-0.02	0.00
-13	-1.02	-0.14	-0.02	0.00
-15	-0.93	-0.14	-0.03	0.03
			Total	0.35



NOTES:
- i.e. -R=6.16m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**230909-B-VERT-5**	**FLOW RATE 5**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.67E-03	1.46E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.51E-02	2.29E-02
9.56E-03	1.45E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

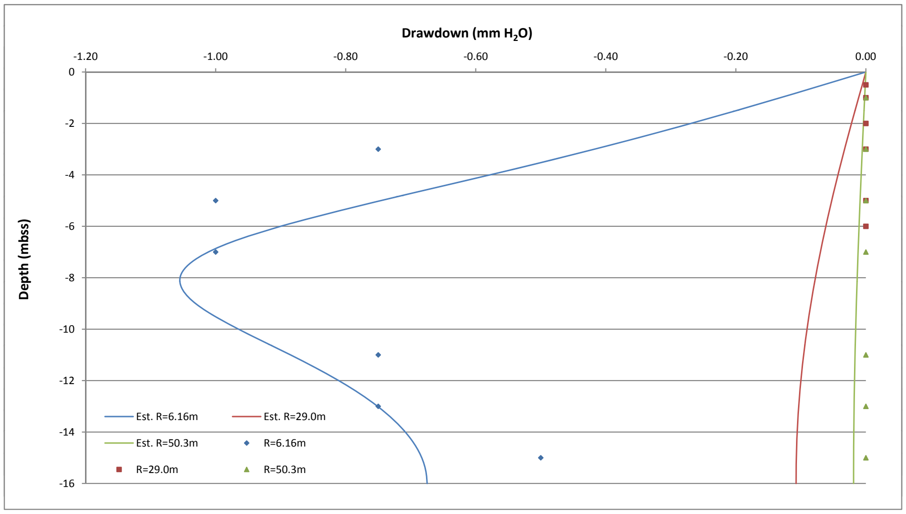
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.50E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m (mm H_2O)	**CMT 147** R=29.0m (mm H_2O)	**CMT 143** R=50.3m (mm H_2O)
-0.5	-	0	-
-1	0	0	0
-2	-	0	-
-3	-0.75	0	0
-5	-1	0	0
-6	-	0	-
-7	-1	-	0
-11	-0.75	-	0
-13	-0.75	-	0
-15	-0.5	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH (mm H_2O)	**CMT 147** R=29.0m TH (mm H_2O)	**CMT 143** R=50.3m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.07	-0.01	0.00	0.00
-1	-0.13	-0.01	0.00	0.02
-2	-0.27	-0.02	0.00	0.00
-3	-0.42	-0.03	-0.01	0.11
-5	-0.75	-0.05	-0.01	0.07
-6	-0.90	-0.06	-0.01	0.00
-7	-1.01	-0.07	-0.01	0.00
-11	-0.89	-0.10	-0.02	0.02
-13	-0.75	-0.10	-0.02	0.00
-15	-0.68	-0.11	-0.02	0.03
			Total	0.25



NOTES:

- i.e. -R=6.16m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

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Packer Test: **230909-B-VERT-6** **FLOW RATE 1**

Client: Syncrude Canada Ltd.

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.34E-03	1.41E-02
1.43E-02	2.16E-02
1.89E-02	2.86E-02
1.41E-02	2.13E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

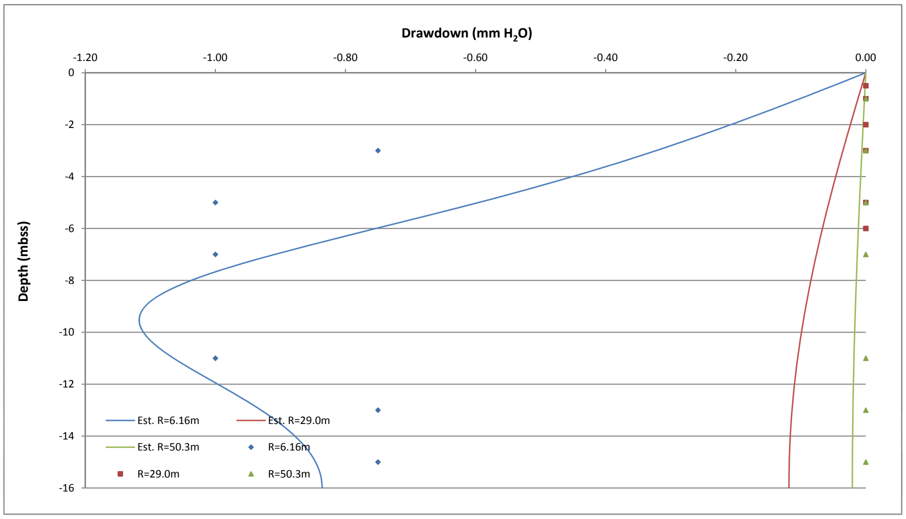
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.50E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m ($mm\ H_2O$)	**CMT 147** R=29.0m ($mm\ H_2O$)	**CMT 143** R=50.3m ($mm\ H_2O$)
-0.5	-	0	-
-1	0	0	0
-2	-	0	-
-3	-0.75	0	0
-5	-1	0	0
-6	-	0	-
-7	-1	-	0
-11	-1	-	0
-13	-0.75	-	0
-15	-0.75	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH ($mm\ H_2O$)	**CMT 147** R=29.0m TH ($mm\ H_2O$)	**CMT 143** R=50.3m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.05	-0.01	0.00	0.00
-1	-0.10	-0.01	0.00	0.01
-2	-0.21	-0.02	0.00	0.00
-3	-0.32	-0.04	-0.01	0.18
-5	-0.60	-0.06	-0.01	0.17
-6	-0.75	-0.07	-0.01	0.00
-7	-0.91	-0.08	-0.01	0.01
-11	-1.06	-0.10	-0.02	0.00
-13	-0.93	-0.11	-0.02	0.03
-15	-0.85	-0.12	-0.02	0.01
			Total	0.42



NOTES:

- i.e. -R=6.16m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

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Packer Test:	**230909-B-VERT-6**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

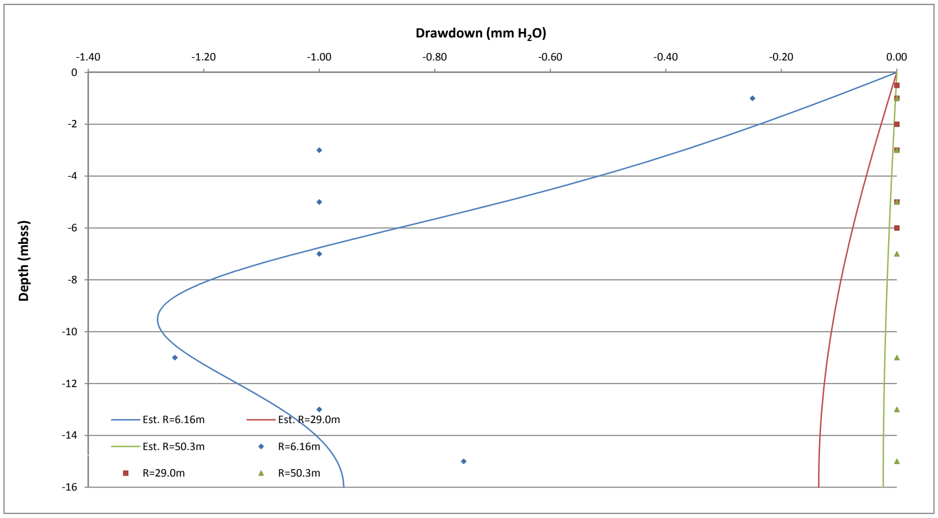
K_{gx} (m/s)	**KR** (-)	**KD** (-)
2.00E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m (mm H_2O)	**CMT 147** R=29.0m (mm H_2O)	**CMT 143** R=50.3m (mm H_2O)
-0.5	-	0	-
-1	-0.25	0	0
-2	-	0	-
-3	-1	0	0
-5	-1	0	0
-6	-	0	-
-7	-1	-	0
-11	-1.25	-	0
-13	-1	-	0
-15	-0.75	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH (mm H_2O)	**CMT 147** R=29.0m TH (mm H_2O)	**CMT 143** R=50.3m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.06	-0.01	0.00	0.00
-1	-0.12	-0.01	0.00	0.02
-2	-0.24	-0.03	0.00	0.00
-3	-0.37	-0.04	-0.01	0.40
-5	-0.68	-0.07	-0.01	0.11
-6	-0.86	-0.08	-0.01	0.01
-7	-1.04	-0.09	-0.02	0.00
-11	-1.22	-0.12	-0.02	0.00
-13	-1.07	-0.13	-0.02	0.00
-15	-0.97	-0.13	-0.02	0.05
			Total	0.59



NOTES:
- i.e. -R=6.16m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**230909-B-VERT-6**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^{o}C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.34E-03	1.41E-02
1.43E-02	2.16E-02
1.89E-02	2.86E-02
1.41E-02	2.13E-02
9.44E-03	1.43E-02

μ_g (Pa s)	**ρ_g** (kg/m^3)	**ρ_w** (kg/m^3)
1.70E-05	1.23	999.68

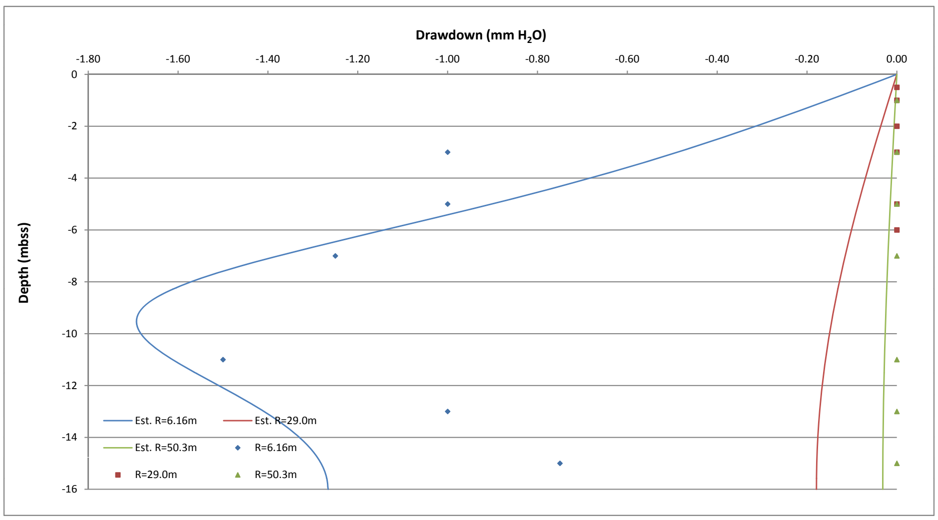
K_{gx} (m/s)	**KR** (-)	**KD** (-)
2.00E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m ($mm\ H_2O$)	**CMT 147** R=29.0m ($mm\ H_2O$)	**CMT 143** R=50.3m ($mm\ H_2O$)
-0.5	-	0	-
-1	0	0	0
-2	-	0	-
-3	-1	0	0
-5	-1	0	0
-6	-	0	-
-7	-1.25	-	0
-11	-1.5	-	0
-13	-1	-	0
-15	-0.75	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH ($mm\ H_2O$)	**CMT 147** R=29.0m TH ($mm\ H_2O$)	**CMT 143** R=50.3m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.08	-0.01	0.00	0.00
-1	-0.15	-0.02	0.00	0.02
-2	-0.31	-0.04	-0.01	0.00
-3	-0.49	-0.05	-0.01	0.26
-5	-0.90	-0.09	-0.01	0.02
-6	-1.14	-0.10	-0.02	0.01
-7	-1.38	-0.12	-0.02	0.02
-11	-1.61	-0.16	-0.03	0.01
-13	-1.41	-0.17	-0.03	0.17
-15	-1.28	-0.18	-0.03	0.28
			Total	0.80



NOTES:

- i.e. -R=6.16m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**230909-B-VERT-6**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.34E-03	1.41E-02
1.43E-02	2.16E-02
1.89E-02	2.86E-02
1.41E-02	2.13E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

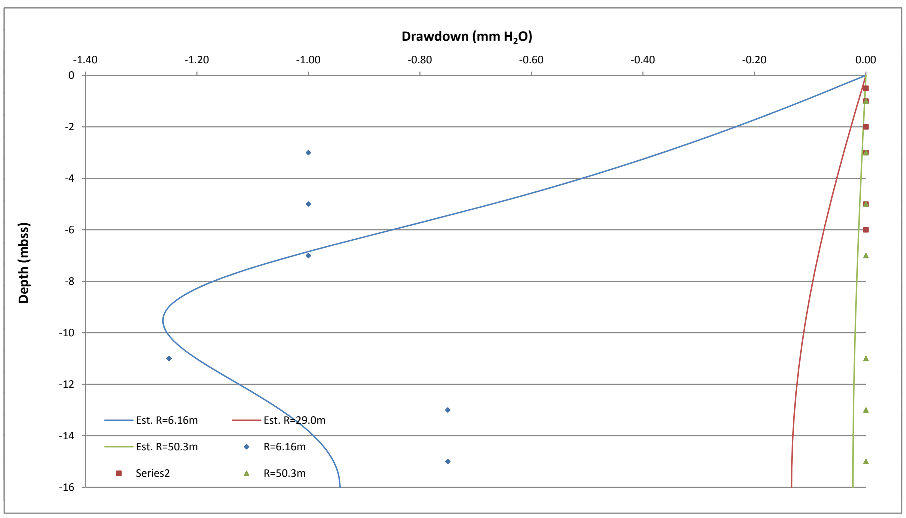
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.00E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m ($mm\ H_2O$)	**CMT 147** R=29.0m ($mm\ H_2O$)	**CMT 143** R=50.3m ($mm\ H_2O$)
-0.5	-	0	-
-1	0	0	0
-2	-	0	-
-3	-1	0	0
-5	-1	0	0
-6	-	0	-
-7	-1	-	0
-11	-1.25	-	0
-13	-0.75	-	0
-15	-0.75	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH ($mm\ H_2O$)	**CMT 147** R=29.0m TH ($mm\ H_2O$)	**CMT 143** R=50.3m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.06	-0.01	0.00	0.00
-1	-0.11	-0.01	0.00	0.01
-2	-0.23	-0.03	0.00	0.00
-3	-0.36	-0.04	-0.01	0.41
-5	-0.67	-0.06	-0.01	0.11
-6	-0.85	-0.08	-0.01	0.01
-7	-1.03	-0.09	-0.01	0.00
-11	-1.20	-0.12	-0.02	0.00
-13	-1.05	-0.13	-0.02	0.09
-15	-0.96	-0.13	-0.02	0.04
			Total	0.67



NOTES:
- i.e. -R=6.16m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	230909-B-VERT-6	FLOW RATE 5
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^{o}C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	Flux (m/s)
9.34E-03	1.41E-02
1.43E-02	2.16E-02
1.89E-02	2.86E-02
1.41E-02	2.13E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

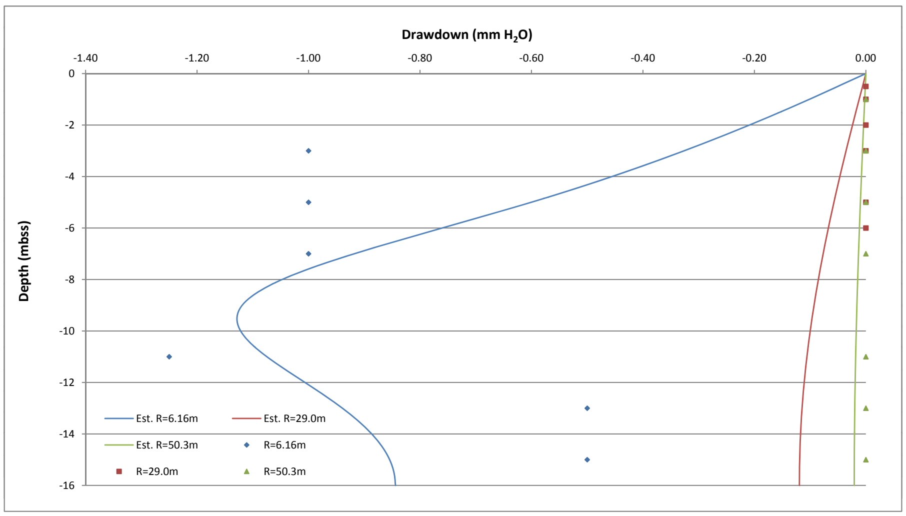
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.50E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	CMT 144 R=6.16m (mm H_2O)	CMT 147 R=29.0m (mm H_2O)	CMT 143 R=50.3m (mm H_2O)
-0.5	-	0	-
-1	0	0	0
-2	-	0	-
-3	-1	0	0
-5	-1	0	0
-6	-	0	-
-7	-1	-	0
-11	-1.25	-	0
-13	-0.5	-	0
-15	-0.5	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	CMT 144 R=6.16m TH (mm H_2O)	CMT 147 R=29.0m TH (mm H_2O)	CMT 143 R=50.3m TH (mm H_2O)	SLS (mm^2 H_2O)
-0.5	-0.05	-0.01	0.00	0.00
-1	-0.10	-0.01	0.00	0.01
-2	-0.21	-0.02	0.00	0.00
-3	-0.33	-0.04	-0.01	0.46
-5	-0.60	-0.06	-0.01	0.16
-6	-0.76	-0.07	-0.01	0.00
-7	-0.92	-0.08	-0.01	0.01
-11	-1.07	-0.11	-0.02	0.03
-13	-0.94	-0.11	-0.02	0.19
-15	-0.85	-0.12	-0.02	0.13
			Total	0.99



NOTES:
- i.e. -R=6.16m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**230909-B-VERT-7**	**FLOW RATE 1**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.43E-02	2.16E-02
1.89E-02	2.86E-02
1.41E-02	2.13E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.71E-05	1.22	999.68

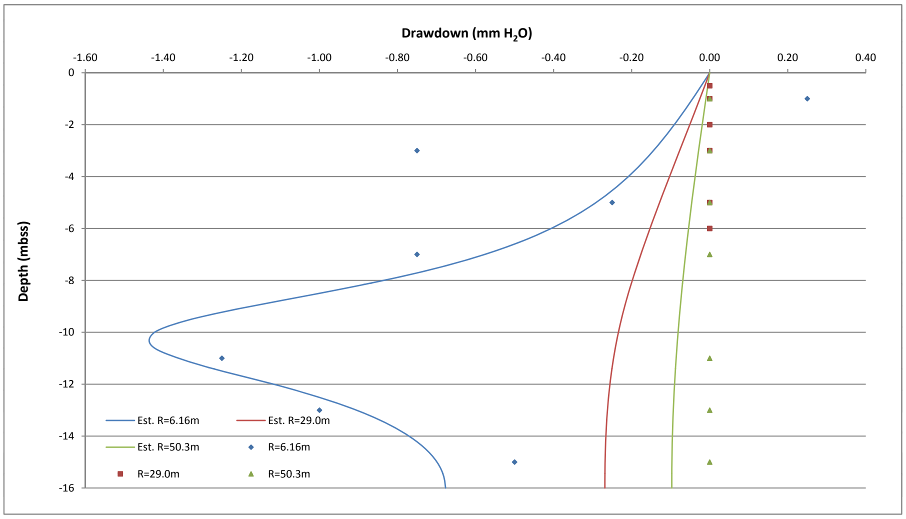
K_{gx} (m/s)	A_{gr} (-)	KD (-)
3.00E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m (mm H_2O)	**CMT 147** R=29.0m (mm H_2O)	**CMT 143** R=50.3m (mm H_2O)
-0.5	-	0	-
-1	0.25	0	0
-2	-	0	-
-3	-0.75	0	0
-5	-0.25	0	0
-6	-	0	-
-7	-0.75	-	0
-11	-1.25	-	0
-13	-1	-	0
-15	-0.5	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH (mm H_2O)	**CMT 147** R=29.0m TH (mm H_2O)	**CMT 143** R=50.3m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.02	-0.01	0.00	0.00
-1	-0.04	-0.03	-0.01	0.09
-2	-0.09	-0.05	-0.02	0.00
-3	-0.14	-0.08	-0.03	0.37
-5	-0.29	-0.13	-0.05	0.02
-6	-0.41	-0.15	-0.05	0.02
-7	-0.58	-0.18	-0.06	0.03
-11	-1.36	-0.25	-0.09	0.02
-13	-0.91	-0.26	-0.09	0.02
-15	-0.70	-0.27	-0.10	0.05
			Total	0.63



NOTES:

- i.e. -R=6.16m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**230909-B-VERT-7**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Syncrude

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.71E-05	1.22	999.68

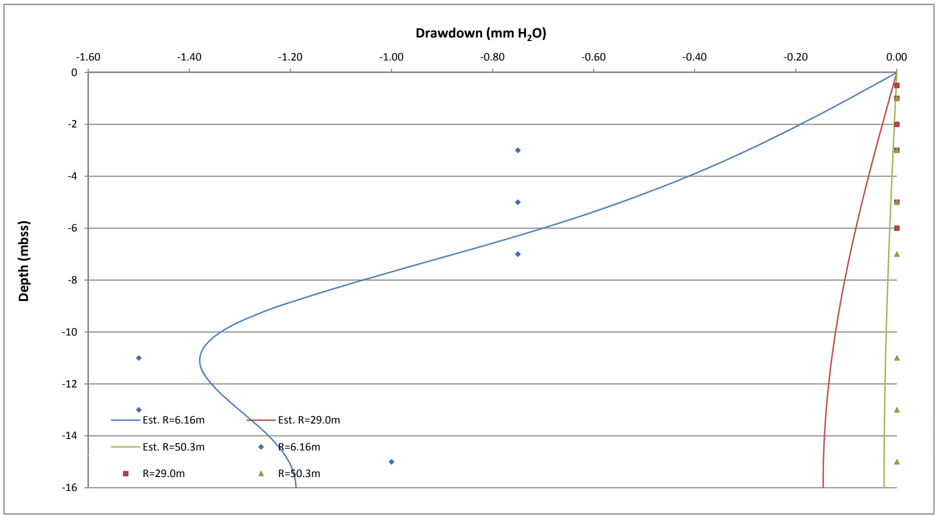
K_{gx} (m/s)	**KR** (-)	**KD** (-)
2.00E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m ($mm H_2O$)	**CMT 147** R=29.0m ($mm H_2O$)	**CMT 143** R=50.3m ($mm H_2O$)
-0.5	-	0	-
-1	0	0	0
-2	-	0	-
-3	-0.75	0	0
-5	-0.75	0	0
-6	-	0	-
-7	-0.75	-	0
-11	-1.5	-	0
-13	-1.5	-	0
-15	-1	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH ($mm H_2O$)	**CMT 147** R=29.0m TH ($mm H_2O$)	**CMT 143** R=50.3m TH ($mm H_2O$)	**SLS** ($mm^2 H_2O$)
-0.5	-0.05	-0.01	0.00	0.00
-1	-0.09	-0.01	0.00	0.01
-2	-0.19	-0.03	0.00	0.00
-3	-0.30	-0.04	-0.01	0.21
-5	-0.55	-0.07	-0.01	0.05
-6	-0.70	-0.08	-0.01	0.01
-7	-0.87	-0.09	-0.02	0.02
-11	-1.38	-0.13	-0.02	0.02
-13	-1.30	-0.14	-0.02	0.04
-15	-1.20	-0.15	-0.03	0.04
			Total	0.38



NOTES:

- i.e. -R=6.16m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

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Packer Test:	**230909-B-VERT-7**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.43E-02	2.16E-02
1.89E-02	2.86E-02
1.41E-02	2.13E-02
9.44E-03	1.43E-02

μ_g (Pa s)	**ρ_g** (kg/m^3)	**ρ_w** (kg/m^3)
1.71E-05	1.22	999.68

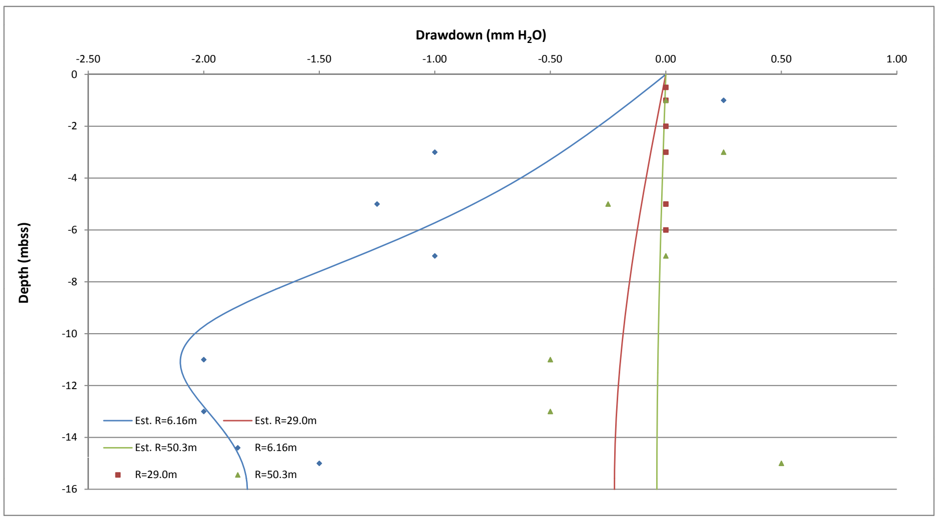
K_{gx} (m/s)	**KR** (-)	**KD** (-)
1.75E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m ($mm\ H_2O$)	**CMT 147** R=29.0m ($mm\ H_2O$)	**CMT 143** R=50.3m ($mm\ H_2O$)
-0.5	-	0	-
-1	0.25	0	0
-2	-	0	-
-3	-1	0	0.25
-5	-1.25	0	-0.25
-6	-	0	-
-7	-1	-	0
-11	-2	-	-0.5
-13	-2	-	-0.5
-15	-1.5	-	0.5

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH ($mm\ H_2O$)	**CMT 147** R=29.0m TH ($mm\ H_2O$)	**CMT 143** R=50.3m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.07	-0.01	0.00	0.00
-1	-0.14	-0.02	0.00	0.15
-2	-0.29	-0.04	-0.01	0.00
-3	-0.45	-0.06	-0.01	0.37
-5	-0.83	-0.10	-0.02	0.24
-6	-1.07	-0.12	-0.02	0.02
-7	-1.33	-0.14	-0.02	0.11
-11	-2.10	-0.20	-0.03	0.23
-13	-1.98	-0.21	-0.04	0.21
-15	-1.83	-0.22	-0.04	0.40
			Total	1.74



NOTES:

- i.e. -R=6.16m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**230909-B-VERT-7**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.43E-02	2.16E-02
1.89E-02	2.86E-02
1.41E-02	2.13E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.71E-05	1.22	999.68

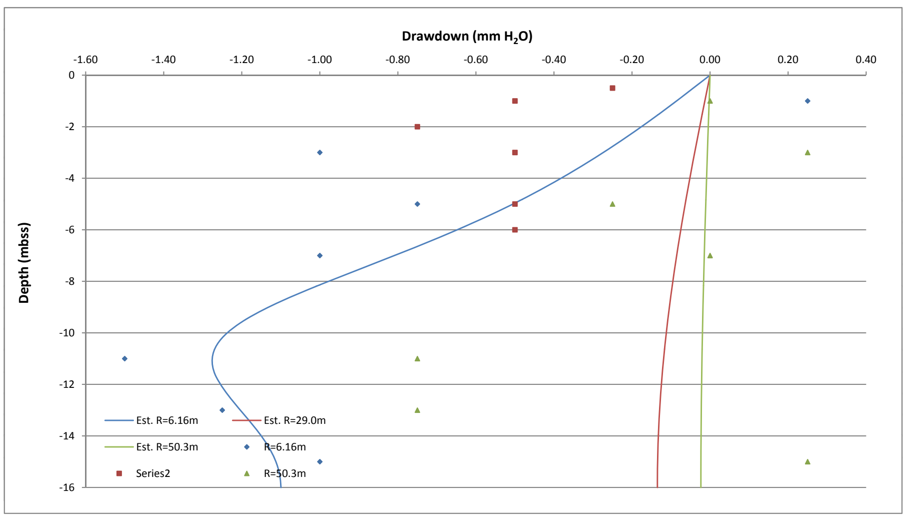
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.00E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m ($mm\ H_2O$)	**CMT 147** R=29.0m ($mm\ H_2O$)	**CMT 143** R=50.3m ($mm\ H_2O$)
-0.5	-	-0.25	-
-1	0.25	-0.5	0
-2	-	-0.75	-
-3	-1	-0.5	0.25
-5	-0.75	-0.5	-0.25
-6	-	-0.5	-
-7	-1	-	0
-11	-1.5	-	-0.75
-13	-1.25	-	-0.75
-15	-1	-	0.25

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH ($mm\ H_2O$)	**CMT 147** R=29.0m TH ($mm\ H_2O$)	**CMT 143** R=50.3m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.04	-0.01	0.00	0.06
-1	-0.09	-0.01	0.00	0.35
-2	-0.18	-0.03	0.00	0.52
-3	-0.27	-0.04	-0.01	0.81
-5	-0.51	-0.06	-0.01	0.31
-6	-0.65	-0.08	-0.01	0.18
-7	-0.81	-0.09	-0.01	0.04
-11	-1.28	-0.12	-0.02	0.58
-13	-1.20	-0.13	-0.02	0.53
-15	-1.11	-0.13	-0.02	0.09
			Total	3.47



NOTES:
- i.e. -R=6.16m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**230909-B-VERT-7**	**FLOW RATE 5**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.43E-02	2.16E-02
1.89E-02	2.86E-02
1.41E-02	2.13E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.71E-05	1.22	999.68

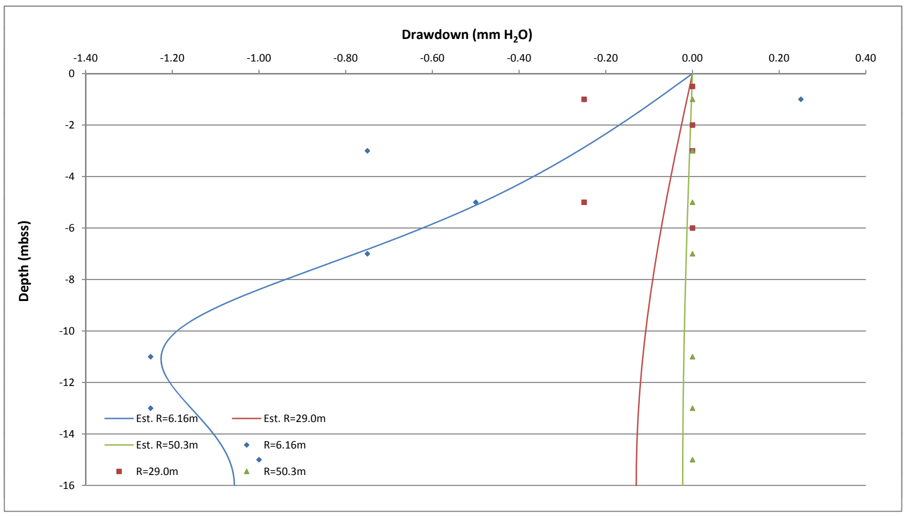
K_{gx} (m/s)	A_{gr} (-)	**KD** (-)
1.50E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m ($mm\ H_2O$)	**CMT 147** R=29.0m ($mm\ H_2O$)	**CMT 143** R=50.3m ($mm\ H_2O$)
-0.5	-	0	-
-1	0.25	-0.25	0
-2	-	0	-
-3	-0.75	0	0
-5	-0.5	-0.25	0
-6	-	0	-
-7	-0.75	-	0
-11	-1.25	-	0
-13	-1.25	-	0
-15	-1	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH ($mm\ H_2O$)	**CMT 147** R=29.0m TH ($mm\ H_2O$)	**CMT 143** R=50.3m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.04	-0.01	0.00	0.00
-1	-0.08	-0.01	0.00	0.17
-2	-0.17	-0.03	0.00	0.00
-3	-0.26	-0.04	-0.01	0.24
-5	-0.49	-0.06	-0.01	0.04
-6	-0.62	-0.07	-0.01	0.01
-7	-0.78	-0.08	-0.01	0.00
-11	-1.23	-0.11	-0.02	0.00
-13	-1.16	-0.12	-0.02	0.01
-15	-1.07	-0.13	-0.02	0.01
			Total	0.46



NOTES:

- i.e. -R=6.16m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**230909-B-VERT-8**	**FLOW RATE 1**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.32E-03	1.41E-02
1.53E-02	2.32E-02
1.90E-02	2.88E-02
1.40E-02	2.13E-02
8.85E-03	1.34E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.22	999.68

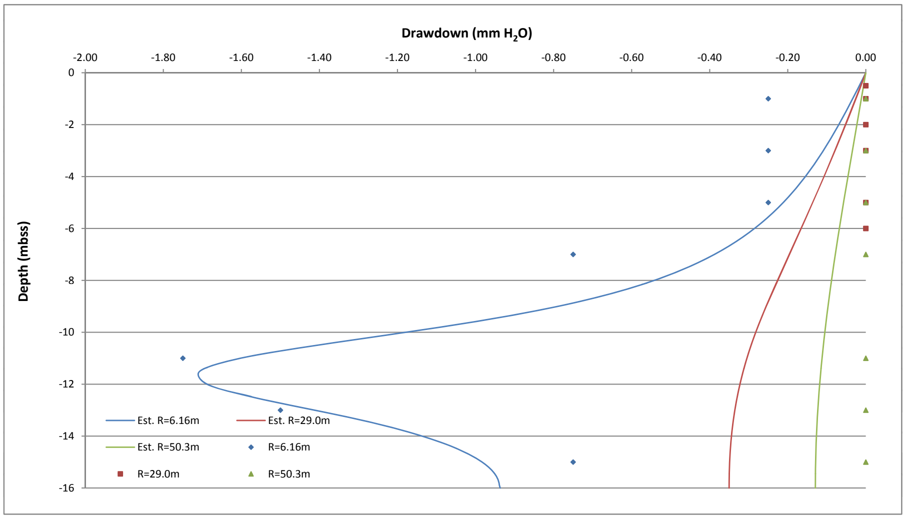
K_{gx} (m/s)	A_{gr} (-)	KD (-)
3.00E-04	0.075	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m (mm H_2O)	**CMT 147** R=29.0m (mm H_2O)	**CMT 143** R=50.3m (mm H_2O)
-0.5	-	0	-
-1	-0.25	0	0
-2	-	0	-
-3	-0.25	0	0
-5	-0.25	0	0
-6	-	0	-
-7	-0.75	-	0
-11	-1.75	-	0
-13	-1.5	-	0
-15	-0.75	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH (mm H_2O)	**CMT 147** R=29.0m TH (mm H_2O)	**CMT 143** R=50.3m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.02	-0.01	-0.01	0.00
-1	-0.03	-0.03	-0.01	0.05
-2	-0.07	-0.05	-0.02	0.00
-3	-0.11	-0.08	-0.03	0.03
-5	-0.21	-0.14	-0.06	0.02
-6	-0.29	-0.17	-0.07	0.03
-7	-0.39	-0.20	-0.08	0.14
-11	-1.60	-0.30	-0.11	0.03
-13	-1.41	-0.34	-0.12	0.02
-15	-0.98	-0.35	-0.13	0.07
			Total	0.39



NOTES:

- i.e. -R=6.16m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

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Packer Test:	**230909-B-VERT-8**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.22	999.68

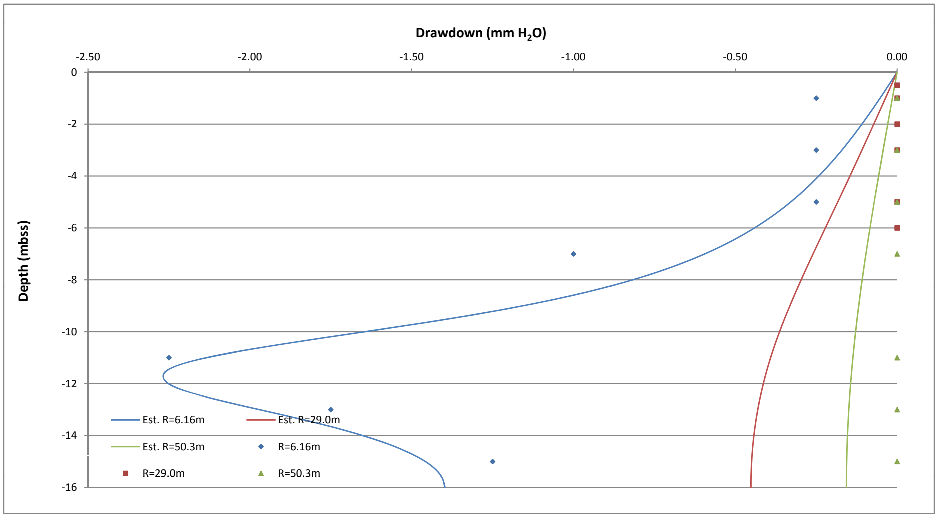
K_{gx} (m/s)	**KR** (-)	**KD** (-)
3.25E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m ($mm H_2O$)	**CMT 147** R=29.0m ($mm H_2O$)	**CMT 143** R=50.3m ($mm H_2O$)
-0.5	-	0	-
-1	-0.25	0	0
-2	-	0	-
-3	-0.25	0	0
-5	-0.25	0	0
-6	-	0	-
-7	-1	-	0
-11	-2.25	-	0
-13	-1.75	-	0
-15	-1.25	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH ($mm H_2O$)	**CMT 147** R=29.0m TH ($mm H_2O$)	**CMT 143** R=50.3m TH ($mm H_2O$)	**SLS** ($mm^2 H_2O$)
-0.5	-0.03	-0.02	-0.01	0.00
-1	-0.05	-0.04	-0.01	0.04
-2	-0.11	-0.07	-0.03	0.01
-3	-0.17	-0.11	-0.04	0.02
-5	-0.33	-0.18	-0.07	0.04
-6	-0.44	-0.22	-0.08	0.05
-7	-0.59	-0.26	-0.10	0.17
-11	-2.14	-0.39	-0.14	0.03
-13	-1.97	-0.43	-0.15	0.07
-15	-1.46	-0.45	-0.16	0.07
			Total	0.50



NOTES:
- i.e. -R=6.16m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**230909-B-VERT-8**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.32E-03	1.41E-02
1.53E-02	2.32E-02
1.90E-02	2.88E-02
1.40E-02	2.13E-02
8.85E-03	1.34E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.22	999.68

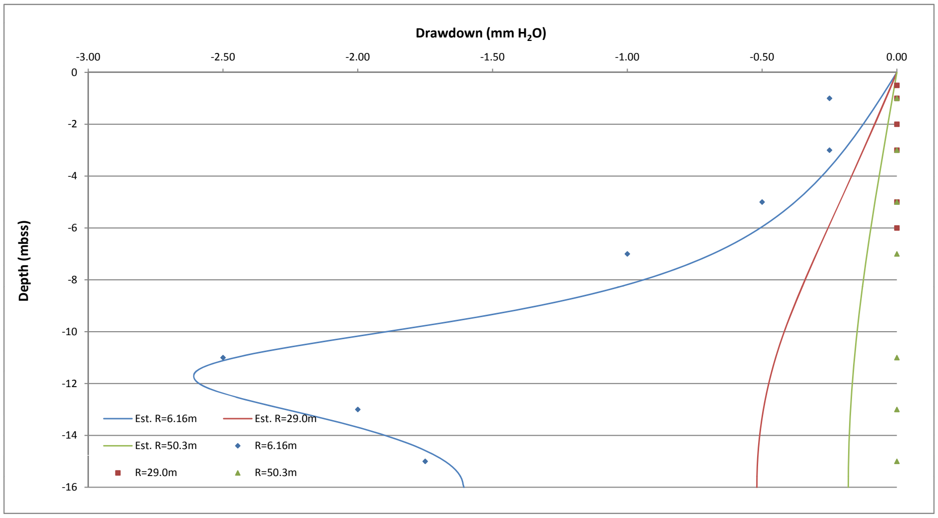
K_{gx} (m/s)	**KR** (-)	**KD** (-)
3.50E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m (mm H_2O)	**CMT 147** R=29.0m (mm H_2O)	**CMT 143** R=50.3m (mm H_2O)
-0.5	-	0	-
-1	-0.25	0	0
-2	-	0	-
-3	-0.25	0	0
-5	-0.5	0	0
-6	-	0	-
-7	-1	-	0
-11	-2.5	-	0
-13	-2	-	0
-15	-1.75	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH (mm H_2O)	**CMT 147** R=29.0m TH (mm H_2O)	**CMT 143** R=50.3m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.03	-0.02	-0.01	0.00
-1	-0.06	-0.04	-0.02	0.04
-2	-0.13	-0.08	-0.03	0.01
-3	-0.20	-0.12	-0.05	0.02
-5	-0.38	-0.21	-0.08	0.07
-6	-0.51	-0.25	-0.10	0.06
-7	-0.68	-0.30	-0.11	0.11
-11	-2.46	-0.45	-0.16	0.03
-13	-2.27	-0.50	-0.17	0.10
-15	-1.68	-0.52	-0.18	0.04
			Total	0.47



NOTES:
- i.e. -R=6.16m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

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Packer Test:	**230909-B-VERT-8**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	23-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.32E-03	1.41E-02
1.53E-02	2.32E-02
1.90E-02	2.88E-02
1.40E-02	2.13E-02
8.85E-03	1.34E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.22	999.68

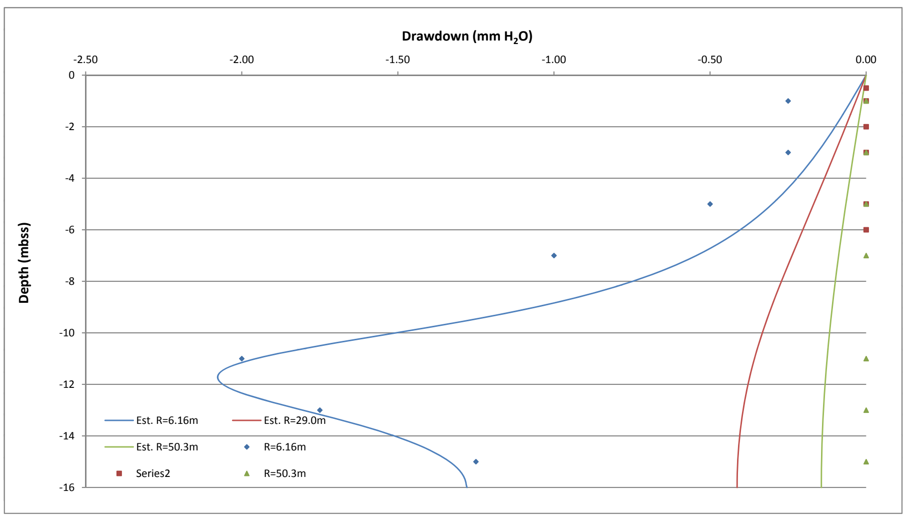
K_{gx} (m/s)	A_{gr} (-)	KD (-)
3.25E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m (mm H_2O)	**CMT 147** R=29.0m (mm H_2O)	**CMT 143** R=50.3m (mm H_2O)
-0.5	-	0	-
-1	-0.25	0	0
-2	-	0	-
-3	-0.25	0	0
-5	-0.5	0	0
-6	-	0	-
-7	-1	-	0
-11	-2	-	0
-13	-1.75	-	0
-15	-1.25	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH (mm H_2O)	**CMT 147** R=29.0m TH (mm H_2O)	**CMT 143** R=50.3m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.02	-0.02	-0.01	0.00
-1	-0.05	-0.03	-0.01	0.04
-2	-0.10	-0.07	-0.03	0.00
-3	-0.16	-0.10	-0.04	0.02
-5	-0.30	-0.17	-0.06	0.07
-6	-0.40	-0.20	-0.08	0.04
-7	-0.54	-0.24	-0.09	0.22
-11	-1.95	-0.36	-0.13	0.02
-13	-1.80	-0.39	-0.14	0.02
-15	-1.33	-0.41	-0.14	0.03
			Total	0.46



NOTES:
- i.e. -R=6.16m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test: **230909-B-VERT-8** **FLOW RATE 5**

Client: Syncrude Canada Ltd.

Test Date	23-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.32E-03	1.41E-02
1.53E-02	2.32E-02
1.90E-02	2.88E-02
1.40E-02	2.13E-02
8.85E-03	1.34E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.22	999.68

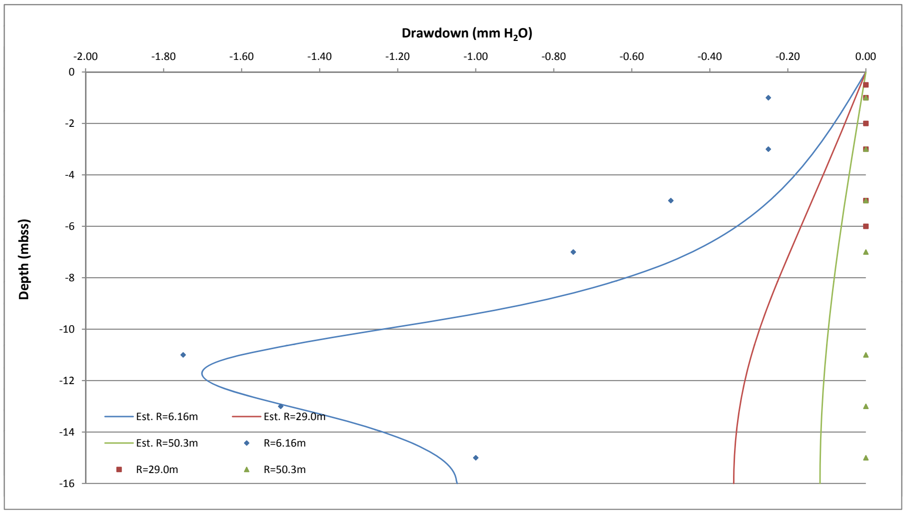
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.50E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=6.16m ($mm\ H_2O$)	**CMT 147** R=29.0m ($mm\ H_2O$)	**CMT 143** R=50.3m ($mm\ H_2O$)
-0.5	-	0	-
-1	-0.25	0	0
-2	-	0	-
-3	-0.25	0	0
-5	-0.5	0	0
-6	-	0	-
-7	-0.75	-	0
-11	-1.75	-	0
-13	-1.5	-	0
-15	-1	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=6.16m TH ($mm\ H_2O$)	**CMT 147** R=29.0m TH ($mm\ H_2O$)	**CMT 143** R=50.3m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.02	-0.01	-0.01	0.00
-1	-0.04	-0.03	-0.01	0.05
-2	-0.08	-0.05	-0.02	0.00
-3	-0.13	-0.08	-0.03	0.02
-5	-0.25	-0.14	-0.05	0.09
-6	-0.33	-0.17	-0.06	0.03
-7	-0.45	-0.19	-0.07	0.10
-11	-1.60	-0.29	-0.10	0.03
-13	-1.48	-0.32	-0.11	0.01
-15	-1.09	-0.34	-0.12	0.02
			Total	0.35



NOTES:

- i.e. -R=6.16m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	220909-B-ANG-1	FLOW RATE 1
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	Flux (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.44E-02	2.18E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.73E-05	1.21	999.68

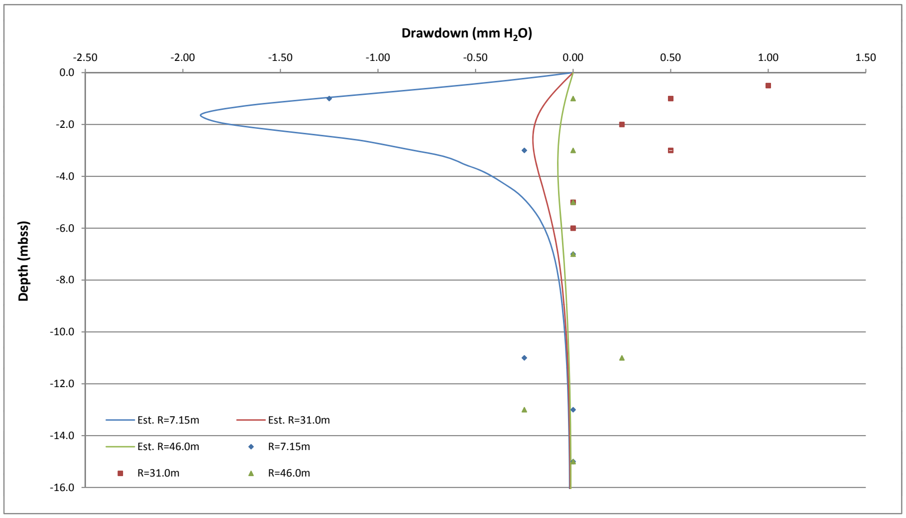
K_{gx} (m/s)	A_{gr} (-)	KD (-)
4.50E-04	0.01	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	CMT 144 R=7.15m ($mm\ H_2O$)	CMT 147 R=31.0m ($mm\ H_2O$)	CMT 143 R=46.0m ($mm\ H_2O$)
-0.5	-	1	-
-1	-1.25	0.5	0
-2	-	0.25	-
-3	-0.25	0.5	0
-5	0.00	0	0
-6	-	0	-
-7	0.00	-	0
-11	-0.25	-	0.25
-13	0.00	-	-0.25
-15	0.00	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	CMT 144 R=7.15m TH ($mm\ H_2O$)	CMT 147 R=31.0m TH ($mm\ H_2O$)	CMT 143 R=46.0m TH ($mm\ H_2O$)	SLS ($mm^2\ H_2O$)
-0.5	-0.79	-0.08	-0.02	1.18
-1	-1.27	-0.12	-0.04	0.39
-2	-1.80	-0.19	-0.06	0.20
-3	-0.88	-0.20	-0.08	0.45
-5	-0.25	-0.14	-0.07	0.09
-6	-0.14	-0.10	-0.06	0.01
-7	-0.10	-0.08	-0.05	0.01
-11	-0.03	-0.03	-0.02	0.12
-13	-0.02	-0.02	-0.02	0.06
-15	-0.02	-0.02	-0.01	0.00
			Total	2.50



NOTES:

- i.e. -R=7.15m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**220909-B-ANG-1**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.73E-05	1.21	999.68

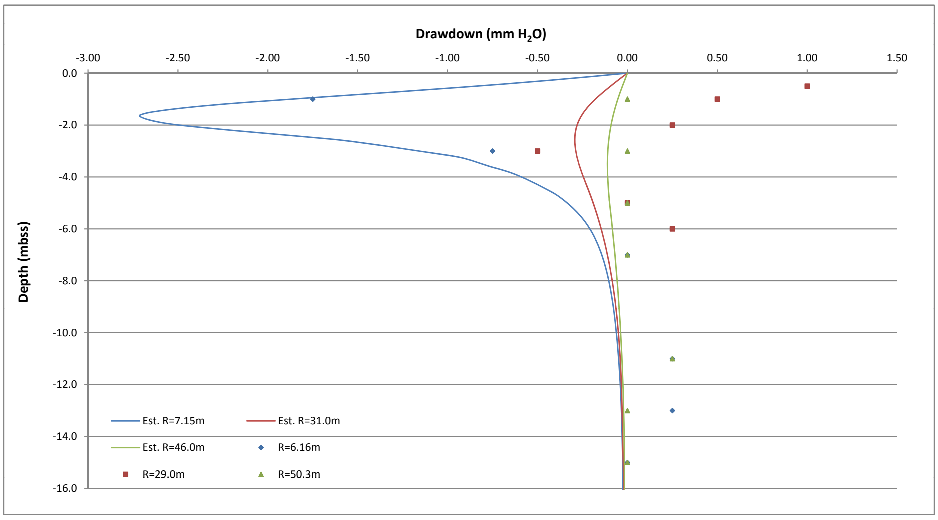
K_{gx} (m/s)	**KR** (-)	**KD** (-)
4.50E-04	0.01	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m (mm H_2O)	**CMT 147** R=31.0m (mm H_2O)	**CMT 143** R=46.0m (mm H_2O)
-0.5	-	1	-
-1	-1.75	0.5	0
-2	-	0.25	-
-3	-0.75	-0.5	0
-5	0.00	0	0
-6	-	0.25	-
-7	0.00	-	0
-11	0.25	-	0.25
-13	0.25	-	0
-15	0.00	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-1.12	-0.12	-0.04	1.26
-1	-1.80	-0.17	-0.05	0.46
-2	-2.56	-0.28	-0.09	0.28
-3	-1.25	-0.29	-0.11	0.35
-5	-0.36	-0.20	-0.10	0.18
-6	-0.20	-0.14	-0.08	0.15
-7	-0.14	-0.11	-0.07	0.02
-11	-0.05	-0.04	-0.03	0.17
-13	-0.03	-0.03	-0.02	0.08
-15	-0.03	-0.02	-0.02	0.00
			Total	2.95



NOTES:

- i.e. -R=7.15m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**220909-B-ANG-1**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.44E-02	2.18E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.73E-05	1.21	999.68

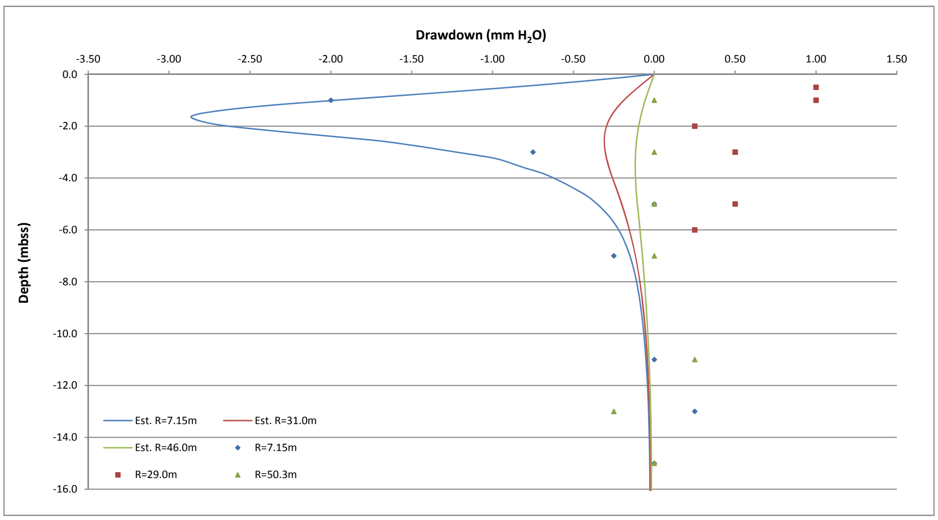
K_{gx} (m/s)	**KR** (-)	**KD** (-)
6.00E-04	0.01	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m ($mm\ H_2O$)	**CMT 147** R=31.0m ($mm\ H_2O$)	**CMT 143** R=46.0m ($mm\ H_2O$)
-0.5	-	1	-
-1	-2.00	1	0
-2	-	0.25	-
-3	-0.75	0.5	0
-5	0.00	0.5	0
-6	-	0.25	-
-7	-0.25	-	0
-11	0.00	-	0.25
-13	0.25	-	-0.25
-15	0.00	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-1.19	-0.13	-0.04	1.27
-1	-1.90	-0.18	-0.05	1.41
-2	-2.71	-0.29	-0.09	0.29
-3	-1.32	-0.30	-0.11	0.43
-5	-0.38	-0.21	-0.11	0.66
-6	-0.21	-0.15	-0.09	0.16
-7	-0.15	-0.11	-0.07	0.02
-11	-0.05	-0.04	-0.03	0.08
-13	-0.04	-0.03	-0.02	0.13
-15	-0.03	-0.02	-0.02	0.00
			Total	4.47



NOTES:
- i.e. -R=7.15m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**220909-B-ANG-1**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.44E-02	2.18E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.73E-05	1.21	999.68

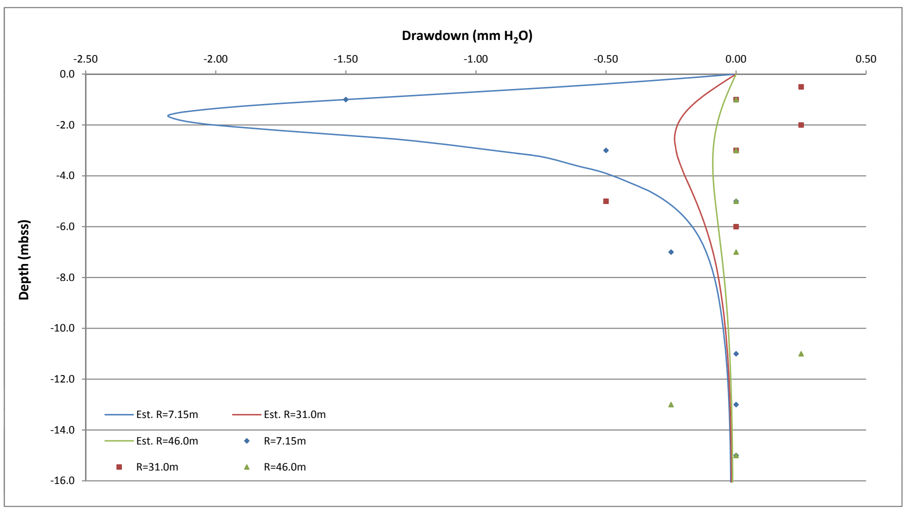
K_{gx} (m/s)	A_{gr} (-)	**KD** (-)
6.00E-04	0.01	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m ($mm\ H_2O$)	**CMT 147** R=31.0m ($mm\ H_2O$)	**CMT 143** R=46.0m ($mm\ H_2O$)
-0.5	-	0.25	-
-1	-1.50	0	0
-2	-	0.25	-
-3	-0.50	0	0
-5	0.00	-0.5	0
-6	-	0	-
-7	-0.25	-	0
-11	0.00	-	0.25
-13	0.00	-	-0.25
-15	0.00	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.90	-0.10	-0.03	0.12
-1	-1.45	-0.14	-0.04	0.02
-2	-2.06	-0.22	-0.07	0.22
-3	-1.01	-0.23	-0.09	0.32
-5	-0.29	-0.16	-0.08	0.21
-6	-0.16	-0.11	-0.07	0.01
-7	-0.11	-0.09	-0.06	0.02
-11	-0.04	-0.03	-0.02	0.08
-13	-0.03	-0.02	-0.02	0.05
-15	-0.02	-0.02	-0.01	0.00
			Total	1.06



NOTES:

- i.e. -R=7.15m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**220909-B-ANG-1**	**FLOW RATE 5**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.44E-02	2.18E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.73E-05	1.21	999.68

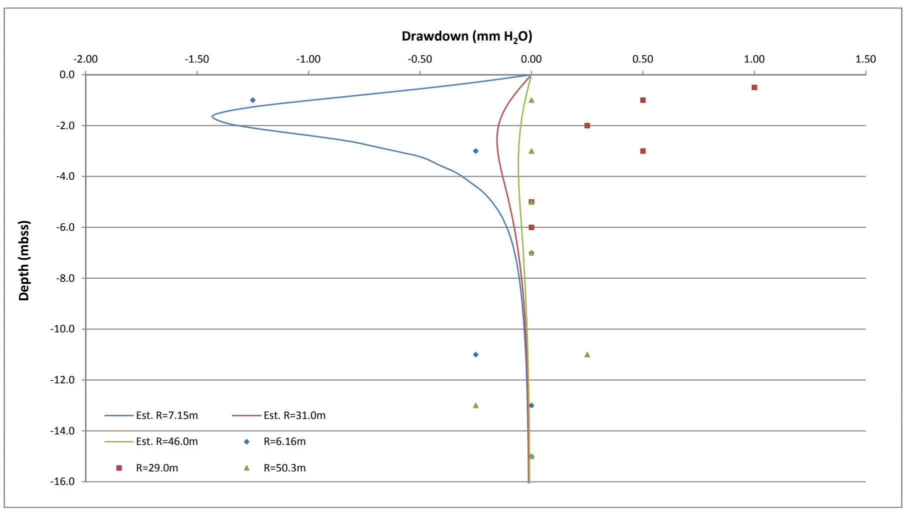
K_{gx} (m/s)	A_{gr} (-)	KD (-)
6.00E-04	0.01	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m ($mm\ H_2O$)	**CMT 147** R=31.0m ($mm\ H_2O$)	**CMT 143** R=46.0m ($mm\ H_2O$)
-0.5	-	1	-
-1	-1.25	0.5	0
-2	-	0.25	-
-3	-0.25	0.5	0
-5	0.00	0	0
-6	-	0	-
-7	0.00	-	0
-11	-0.25	-	0.25
-13	0.00	-	-0.25
-15	0.00	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.59	-0.06	-0.02	0.66
-1	-0.95	-0.09	-0.03	0.44
-2	-1.35	-0.15	-0.05	0.16
-3	-0.66	-0.15	-0.06	0.20
-5	-0.19	-0.11	-0.05	0.05
-6	-0.10	-0.07	-0.04	0.01
-7	-0.07	-0.06	-0.04	0.03
-11	-0.03	-0.02	-0.02	0.08
-13	-0.02	-0.02	-0.01	0.13
-15	-0.01	-0.01	-0.01	0.00
			Total	1.75



NOTES:
- i.e. -R=7.15m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test: **220909-B-ANG-2** **FLOW RATE 1**

Client: Syncrude Canada Ltd.

Test Date	22-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.20E-03	1.39E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.32E-03	1.41E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.71E-05	1.22	999.68

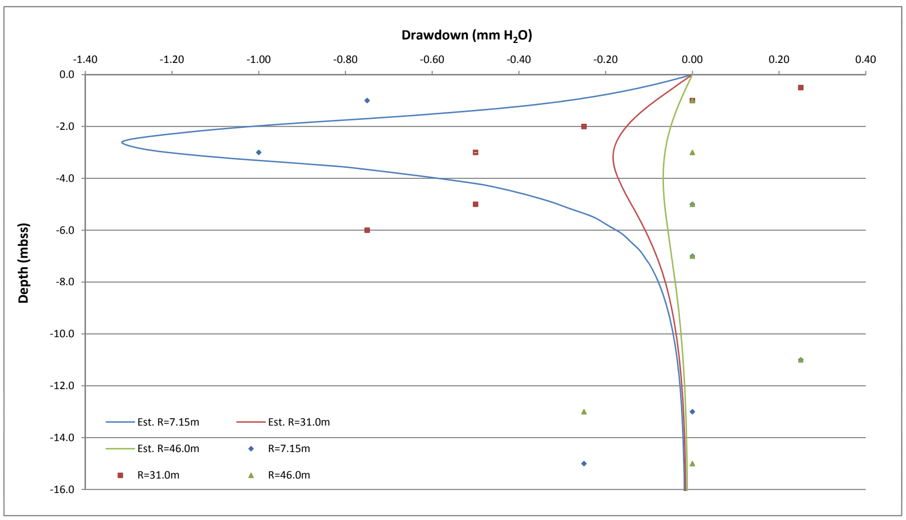
K_{gx} (m/s)	**A_{gr}** (-)	**KD** (-)
7.00E-04	0.01	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m (mm H_2O)	**CMT 147** R=31.0m (mm H_2O)	**CMT 143** R=46.0m (mm H_2O)
-0.5	-	0.25	-
-1	-0.75	0	0
-2	-	-0.25	-
-3	-1.00	-0.5	0
-5	0.00	-0.5	0
-6	-	-0.75	-
-7	0.00	-	0
-11	0.25	-	0.25
-13	0.00	-	-0.25
-15	-0.25	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.16	-0.06	-0.02	0.09
-1	-0.27	-0.08	-0.03	0.23
-2	-0.97	-0.15	-0.05	0.01
-3	-1.25	-0.18	-0.06	0.10
-5	-0.34	-0.15	-0.06	0.24
-6	-0.16	-0.10	-0.06	0.42
-7	-0.11	-0.08	-0.05	0.01
-11	-0.04	-0.03	-0.02	0.16
-13	-0.02	-0.02	-0.02	0.06
-15	-0.02	-0.02	-0.01	0.05
			Total	1.38



NOTES:

- i.e. -R=7.15m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

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Packer Test:	**220909-B-ANG-2**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.71E-05	1.22	999.68

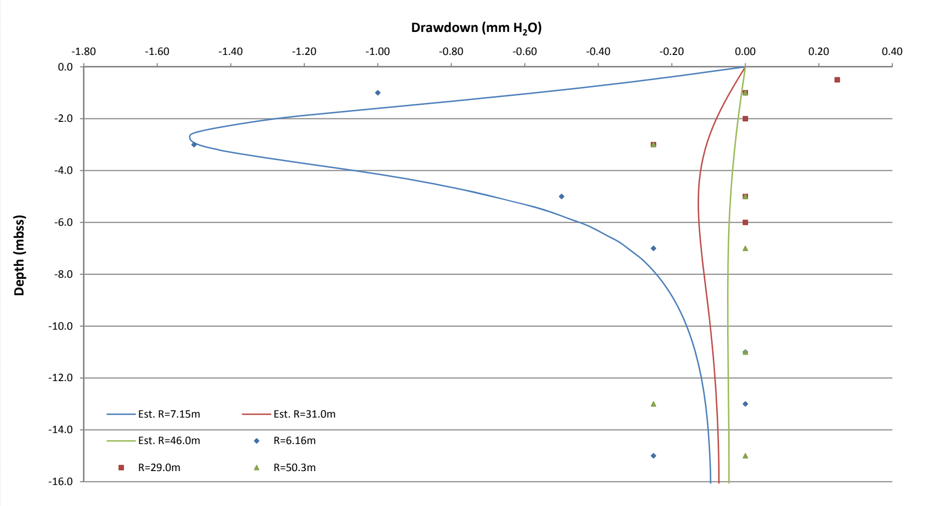
K_{gx} (m/s)	KR (-)	KD (-)
4.00E-04	0.05	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m ($mm\ H_2O$)	**CMT 147** R=31.0m ($mm\ H_2O$)	**CMT 143** R=46.0m ($mm\ H_2O$)
-0.5	-	0.25	-
-1	-1.00	0	0
-2	-	0	-
-3	-1.50	-0.25	-0.25
-5	-0.50	0	0
-6	-	0	-
-7	-0.25	-	0
-11	0.00	-	0
-13	0.00	-	-0.25
-15	-0.25	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.35	-0.03	-0.01	0.08
-1	-0.55	-0.04	-0.01	0.21
-2	-1.24	-0.08	-0.02	0.01
-3	-1.50	-0.10	-0.03	0.06
-5	-0.73	-0.13	-0.04	0.07
-6	-0.43	-0.13	-0.04	0.02
-7	-0.31	-0.12	-0.05	0.01
-11	-0.14	-0.09	-0.05	0.02
-13	-0.11	-0.08	-0.05	0.05
-15	-0.10	-0.07	-0.04	0.03
			Total	0.54



NOTES:
- i.e. -R=7.15m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**220909-B-ANG-2**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.20E-03	1.39E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.32E-03	1.41E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.71E-05	1.22	999.68

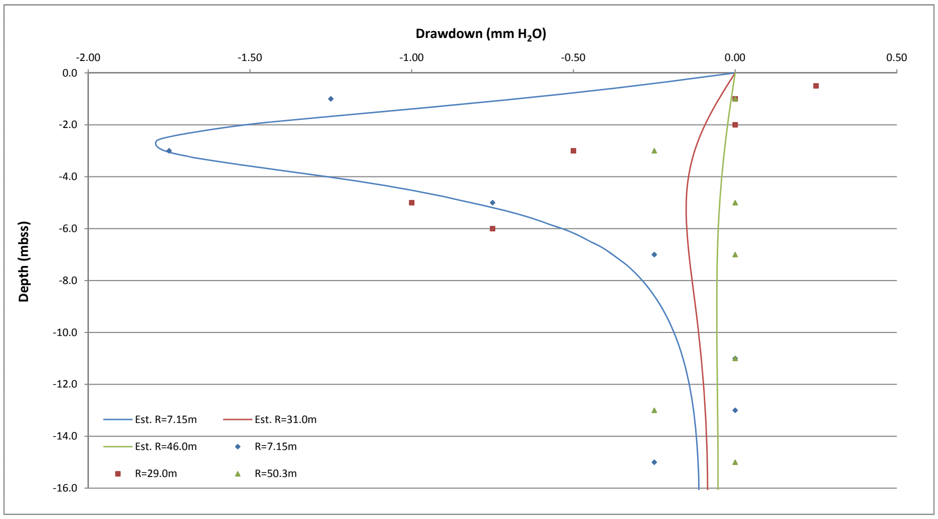
K_{gx} (m/s)	**KR** (-)	**KD** (-)
4.50E-04	0.05	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m ($mm\ H_2O$)	**CMT 147** R=31.0m ($mm\ H_2O$)	**CMT 143** R=46.0m ($mm\ H_2O$)
-0.5	-	0.25	-
-1	-1.25	0	0
-2	-	0	-
-3	-1.75	-0.5	-0.25
-5	-0.75	-1	0
-6	-	-0.75	-
-7	-0.25	-	0
-11	0.00	-	0
-13	0.00	-	-0.25
-15	-0.25	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.41	-0.03	-0.01	0.08
-1	-0.65	-0.05	-0.01	0.36
-2	-1.47	-0.09	-0.02	0.01
-3	-1.78	-0.12	-0.03	0.06
-5	-0.87	-0.15	-0.05	0.74
-6	-0.51	-0.15	-0.05	0.36
-7	-0.37	-0.14	-0.06	0.02
-11	-0.16	-0.10	-0.06	0.03
-13	-0.13	-0.09	-0.05	0.06
-15	-0.11	-0.09	-0.05	0.02
			Total	1.74



NOTES:
- i.e. -R=7.15m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

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Packer Test: **220909-B-ANG-2** **FLOW RATE 4**

Client: Syncrude Canada Ltd.

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.20E-03	1.39E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.32E-03	1.41E-02

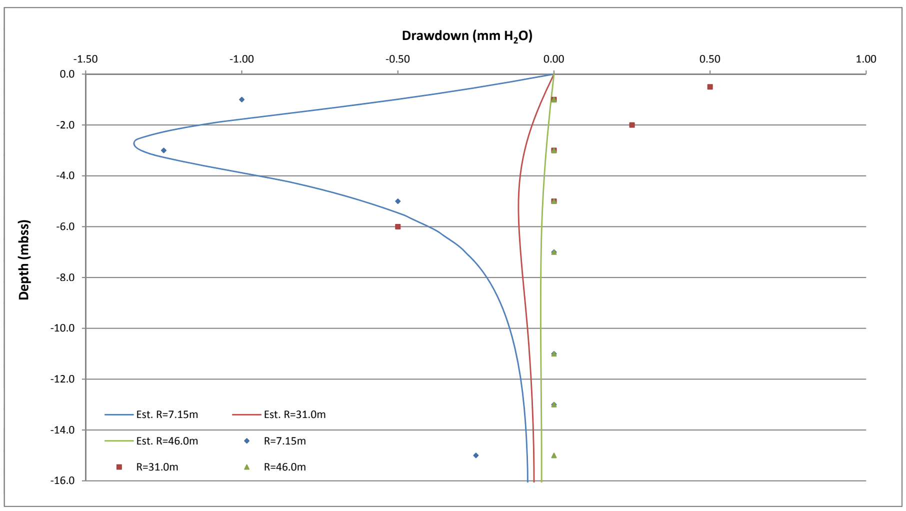
μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.71E-05	1.22	999.68
K_{gx} (m/s)	**A_{gr}** (-)	**KD** (-)
4.50E-04	0.05	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m ($mm\ H_2O$)	**CMT 147** R=31.0m ($mm\ H_2O$)	**CMT 143** R=46.0m ($mm\ H_2O$)
-0.5	-	0.5	-
-1	-1.00	0	0
-2	-	0.25	-
-3	-1.25	0	0
-5	-0.50	0	0
-6	-	-0.5	-
-7	0.00	-	0
-11	0.00	-	0
-13	0.00	-	0
-15	-0.25	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.31	-0.02	-0.01	0.28
-1	-0.49	-0.04	-0.01	0.26
-2	-1.10	-0.07	-0.02	0.10
-3	-1.34	-0.09	-0.02	0.02
-5	-0.65	-0.11	-0.04	0.04
-6	-0.38	-0.11	-0.04	0.15
-7	-0.28	-0.11	-0.04	0.08
-11	-0.12	-0.08	-0.04	0.02
-13	-0.10	-0.07	-0.04	0.01
-15	-0.09	-0.06	-0.04	0.03
			Total	0.98



NOTES:
- i.e. -R=7.15m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**220909-B-ANG-2**	**FLOW RATE 5**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.20E-03	1.39E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.32E-03	1.41E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.71E-05	1.22	999.68

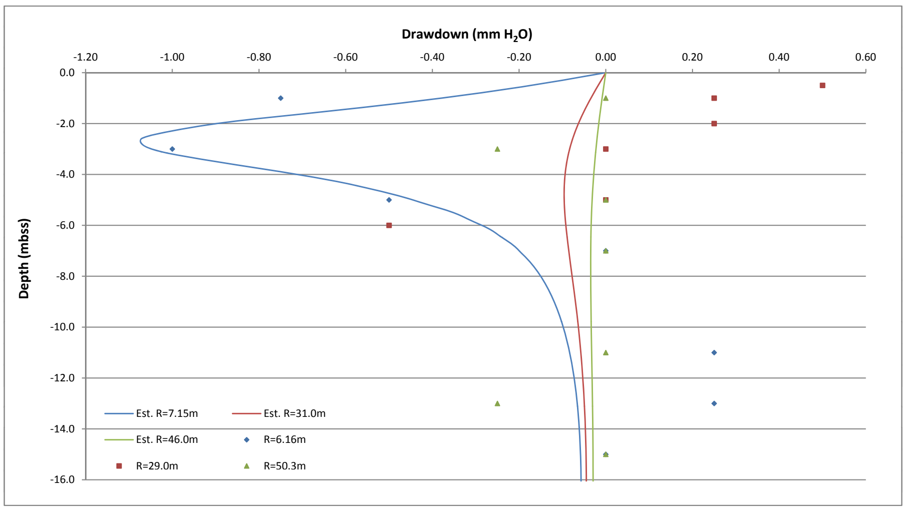
K_{gx} (m/s)	A_{gr} (-)	KD (-)
4.25E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m ($mm\ H_2O$)	**CMT 147** R=31.0m ($mm\ H_2O$)	**CMT 143** R=46.0m ($mm\ H_2O$)
-0.5	-	0.5	-
-1	-0.75	0.25	0
-2	-	0.25	-
-3	-1.00	0	-0.25
-5	-0.50	0	0
-6	-	-0.5	-
-7	0.00	-	0
-11	0.25	-	0
-13	0.25	-	-0.25
-15	0.00	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.23	-0.02	-0.01	0.27
-1	-0.36	-0.03	-0.01	0.23
-2	-0.87	-0.06	-0.02	0.10
-3	-1.06	-0.08	-0.02	0.06
-5	-0.48	-0.10	-0.03	0.01
-6	-0.27	-0.09	-0.03	0.17
-7	-0.19	-0.08	-0.03	0.04
-11	-0.08	-0.06	-0.03	0.11
-13	-0.07	-0.05	-0.03	0.15
-15	-0.06	-0.05	-0.03	0.00
			Total	1.14



NOTES:
- i.e. -R=7.15m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test: **220909-B-ANG-3** **FLOW RATE 1**

Client: Syncrude Canada Ltd.

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.32E-02	2.00E-02
1.65E-02	2.50E-02
1.89E-02	2.86E-02
1.65E-02	2.50E-02
1.42E-02	2.14E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

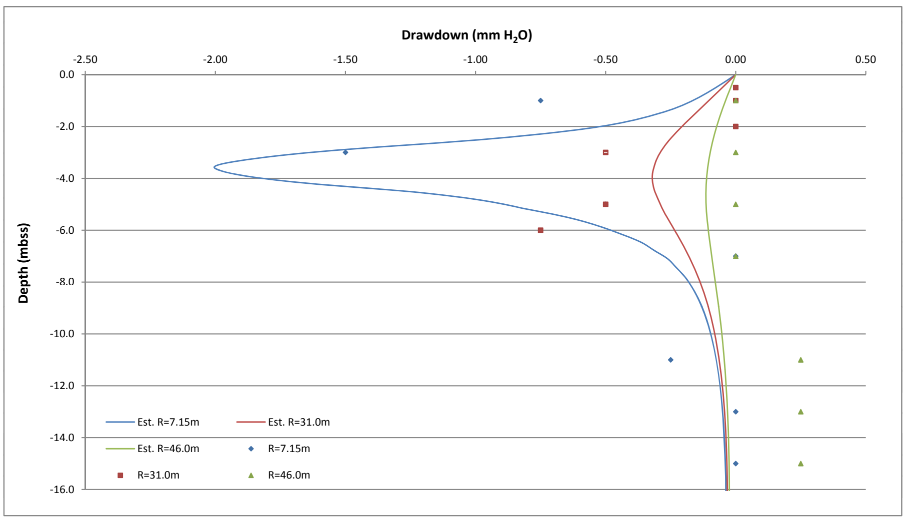
K_{gx} (m/s)	A_{gr} (-)	KD (-)
7.00E-04	0.01	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m ($mm\ H_2O$)	**CMT 147** R=31.0m ($mm\ H_2O$)	**CMT 143** R=46.0m ($mm\ H_2O$)
-0.5	-	0	-
-1	-0.75	0	0
-2	-	0	-
-3	-1.50	-0.5	0
-5	-0.50	-0.5	0
-6	-	-0.75	-
-7	0.00	-	0
-11	-0.25	-	0.25
-13	0.00	-	0.25
-15	0.00	-	0.25

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.10	-0.07	-0.03	0.00
-1	-0.16	-0.10	-0.04	0.36
-2	-0.48	-0.20	-0.07	0.04
-3	-1.53	-0.28	-0.10	0.09
-5	-0.98	-0.30	-0.11	0.28
-6	-0.44	-0.23	-0.10	0.27
-7	-0.26	-0.18	-0.09	0.08
-11	-0.08	-0.06	-0.04	0.12
-13	-0.05	-0.04	-0.03	0.08
-15	-0.04	-0.03	-0.03	0.08
			Total	1.40



NOTES:

- i.e. -R=7.15m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**220909-B-ANG-3**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

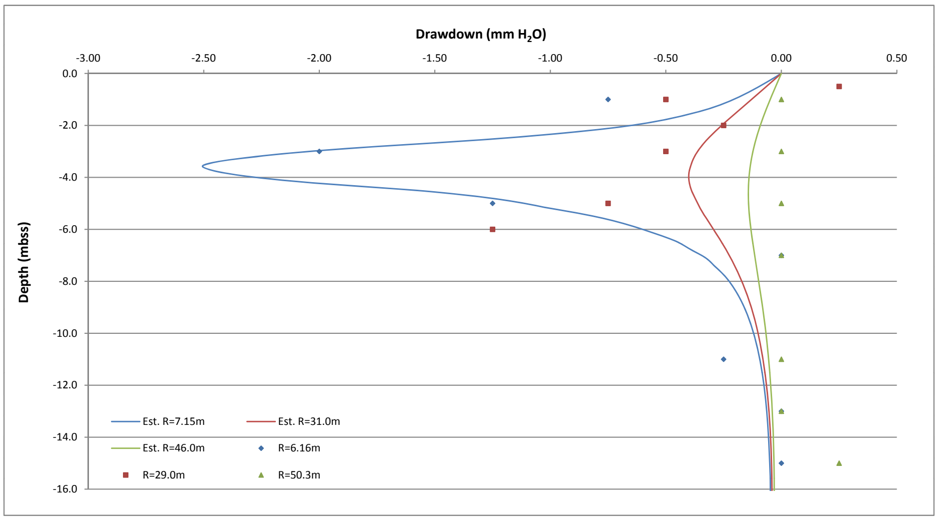
K_{gx} (m/s)	**KR** (-)	**KD** (-)
7.00E-04	0.01	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m ($mm\ H_2O$)	**CMT 147** R=31.0m ($mm\ H_2O$)	**CMT 143** R=46.0m ($mm\ H_2O$)
-0.5	-	0.25	-
-1	-0.75	-0.5	0
-2	-	-0.25	-
-3	-2.00	-0.5	0
-5	-1.25	-0.75	0
-6	-	-1.25	-
-7	0.00	-	0
-11	-0.25	-	0
-13	0.00	-	0
-15	0.00	-	0.25

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.13	-0.08	-0.03	0.11
-1	-0.20	-0.13	-0.05	0.45
-2	-0.60	-0.25	-0.09	0.00
-3	-1.91	-0.36	-0.12	0.15
-5	-1.22	-0.37	-0.14	0.17
-6	-0.55	-0.28	-0.13	0.93
-7	-0.33	-0.22	-0.11	0.12
-11	-0.09	-0.08	-0.06	0.03
-13	-0.06	-0.05	-0.04	0.01
-15	-0.05	-0.04	-0.03	0.08
			Total	2.04



NOTES:

- i.e. -R=7.15m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**220909-B-ANG-3**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.32E-02	2.00E-02
1.65E-02	2.50E-02
1.89E-02	2.86E-02
1.65E-02	2.50E-02
1.42E-02	2.14E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

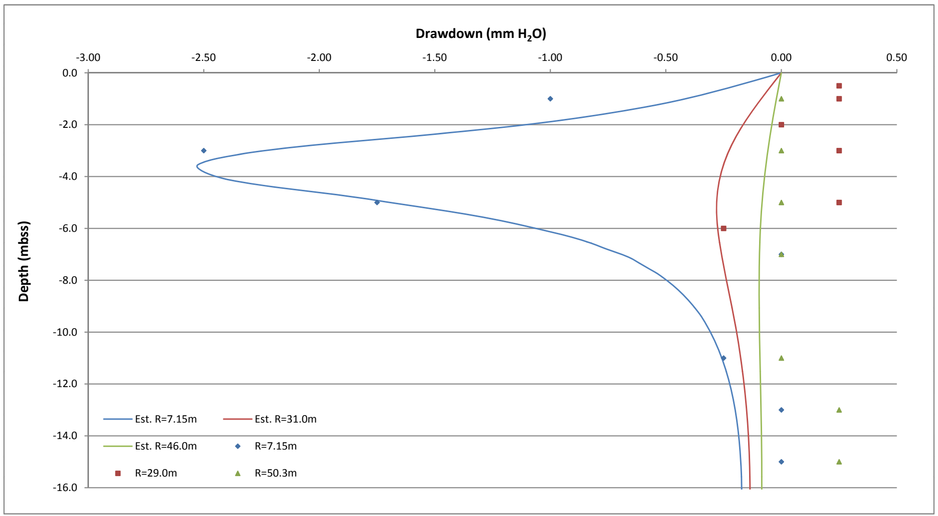
K_{gx} (m/s)	**KR** (-)	**KD** (-)
4.00E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m ($mm\ H_2O$)	**CMT 147** R=31.0m ($mm\ H_2O$)	**CMT 143** R=46.0m ($mm\ H_2O$)
-0.5	-	0.25	-
-1	-1.00	0.25	0
-2	-	0	-
-3	-2.50	0.25	0
-5	-1.75	0.25	0
-6	-	-0.25	-
-7	0.00	-	0
-11	-0.25	-	0
-13	0.00	-	0.25
-15	0.00	-	0.25

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.26	-0.06	-0.01	0.09
-1	-0.40	-0.08	-0.02	0.47
-2	-1.05	-0.16	-0.04	0.03
-3	-2.15	-0.22	-0.06	0.17
-5	-1.81	-0.28	-0.08	0.29
-6	-1.00	-0.27	-0.09	0.00
-7	-0.66	-0.26	-0.10	0.45
-11	-0.26	-0.18	-0.09	0.01
-13	-0.20	-0.15	-0.09	0.16
-15	-0.17	-0.14	-0.09	0.14
			Total	1.81



NOTES:
- i.e. -R=7.15m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**220909-B-ANG-3**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.32E-02	2.00E-02
1.65E-02	2.50E-02
1.89E-02	2.86E-02
1.65E-02	2.50E-02
1.42E-02	2.14E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

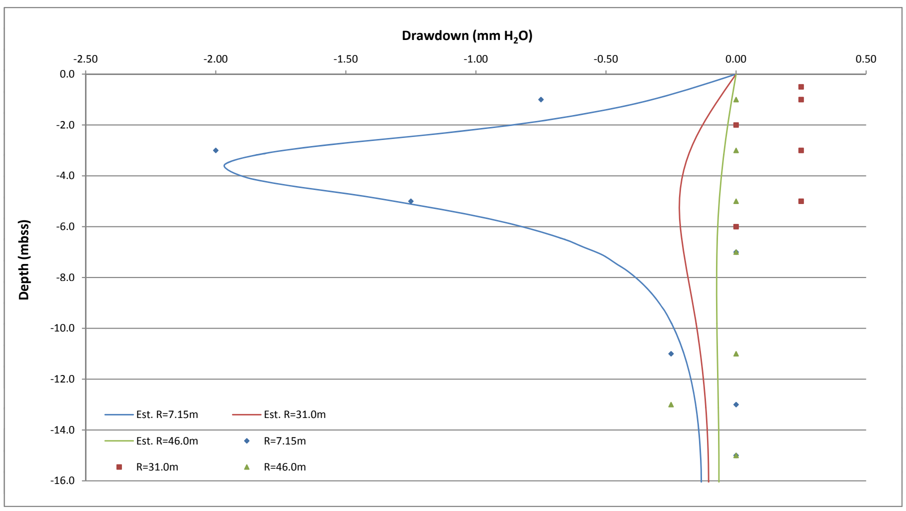
K_{gx} (m/s)	A_{gr} (-)	**KD** (-)
4.50E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m (mm H_2O)	**CMT 147** R=31.0m (mm H_2O)	**CMT 143** R=46.0m (mm H_2O)
-0.5	-	0.25	-
-1	-0.75	0.25	0
-2	-	0	-
-3	-2.00	0.25	0
-5	-1.25	0.25	0
-6	-	0	-
-7	0.00	-	0
-11	-0.25	-	0
-13	0.00	-	-0.25
-15	0.00	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.20	-0.04	-0.01	0.09
-1	-0.31	-0.07	-0.02	0.29
-2	-0.81	-0.12	-0.03	0.02
-3	-1.67	-0.17	-0.04	0.14
-5	-1.41	-0.22	-0.06	0.25
-6	-0.78	-0.21	-0.07	0.05
-7	-0.51	-0.20	-0.07	0.27
-11	-0.20	-0.14	-0.07	0.01
-13	-0.16	-0.12	-0.07	0.06
-15	-0.14	-0.11	-0.07	0.02
			Total	1.18



NOTES:
- i.e. -R=7.15m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test: **220909-B-ANG-3** **FLOW RATE 5**

Client: Syncrude Canada Ltd.

Test Date	22-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.32E-02	2.00E-02
1.65E-02	2.50E-02
1.89E-02	2.86E-02
1.65E-02	2.50E-02
1.42E-02	2.14E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

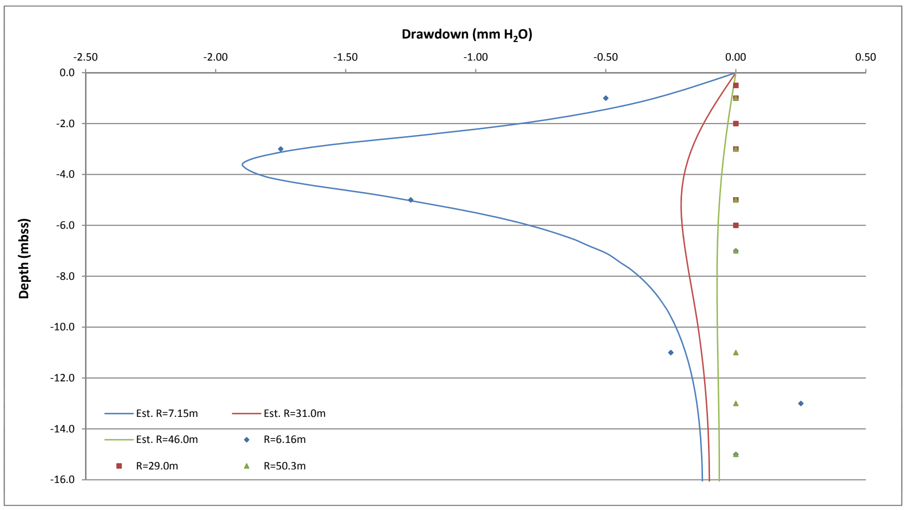
K_{gx} (m/s)	A_{gr} (-)	KD (-)
4.00E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m (mm H_2O)	**CMT 147** R=31.0m (mm H_2O)	**CMT 143** R=46.0m (mm H_2O)
-0.5	-	0	-
-1	-0.50	0	0
-2	-	0	-
-3	-1.75	0	0
-5	-1.25	0	0
-6	-	0	-
-7	0.00	-	0
-11	-0.25	-	0
-13	0.25	-	0
-15	0.00	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.19	-0.04	-0.01	0.00
-1	-0.30	-0.06	-0.02	0.04
-2	-0.78	-0.12	-0.03	0.01
-3	-1.62	-0.17	-0.04	0.05
-5	-1.35	-0.21	-0.06	0.06
-6	-0.75	-0.21	-0.07	0.04
-7	-0.50	-0.19	-0.07	0.25
-11	-0.19	-0.13	-0.07	0.01
-13	-0.15	-0.11	-0.07	0.17
-15	-0.13	-0.10	-0.06	0.02
			Total	0.66



NOTES:

- i.e. -R=7.15m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**220909-B-ANG-4**	**FLOW RATE 1**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.32E-02	2.00E-02
1.65E-02	2.50E-02
1.89E-02	2.86E-02
1.65E-02	2.50E-02
1.42E-02	2.14E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

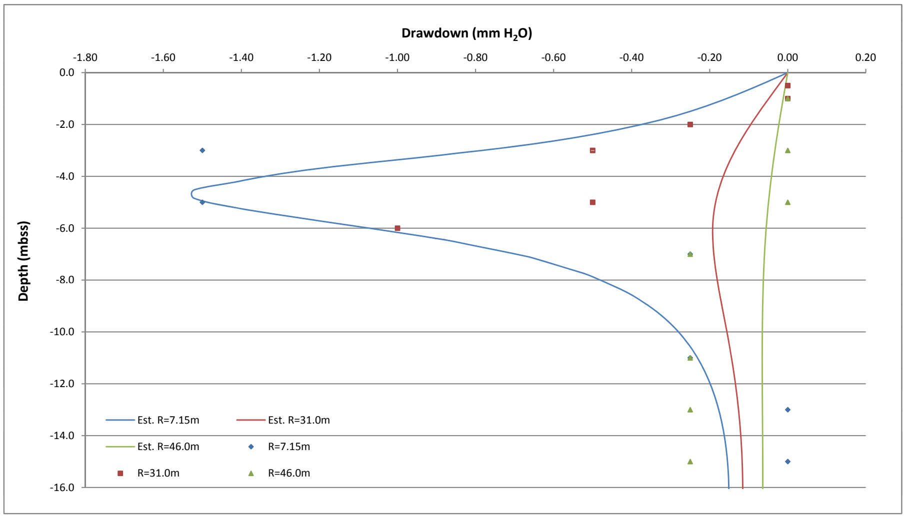
K_{gx} (m/s)	A_{gr} (-)	KD (-)
4.25E-04	0.05	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth	**CMT 144**	**CMT 147**	**CMT 143**
	R=7.15m	R=31.0m	R=46.0m
(mbss)	(mm H_2O)	(mm H_2O)	(mm H_2O)
-0.5	-	0	-
-1	0.00	0	0
-2	-	-0.25	-
-3	-1.50	-0.5	0
-5	-1.50	-0.5	0
-6	-	-1	-
-7	-0.25	-	-0.25
-11	-0.25	-	-0.25
-13	0.00	-	-0.25
-15	0.00	-	-0.25

Simulated Drawdown at Monitoring Locations

Port Depth	**CMT 144**	**CMT 147**	**CMT 143**	**SLS**
	R=7.15m	R=31.0m	R=46.0m	
(mbss)	TH (mm H_2O)	TH (mm H_2O)	TH (mm H_2O)	(mm^2 H_2O)
-0.5	-0.10	-0.03	-0.01	0.00
-1	-0.15	-0.05	-0.01	0.03
-2	-0.36	-0.09	-0.02	0.02
-3	-0.73	-0.13	-0.03	0.61
-5	-1.52	-0.18	-0.05	0.10
-6	-1.01	-0.19	-0.06	0.65
-7	-0.66	-0.19	-0.06	0.21
-11	-0.23	-0.14	-0.07	0.03
-13	-0.18	-0.13	-0.06	0.07
-15	-0.15	-0.12	-0.06	0.06
			Total	1.78



NOTES:
- i.e. -R=7.15m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**220909-B-ANG-4**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (^{o}C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

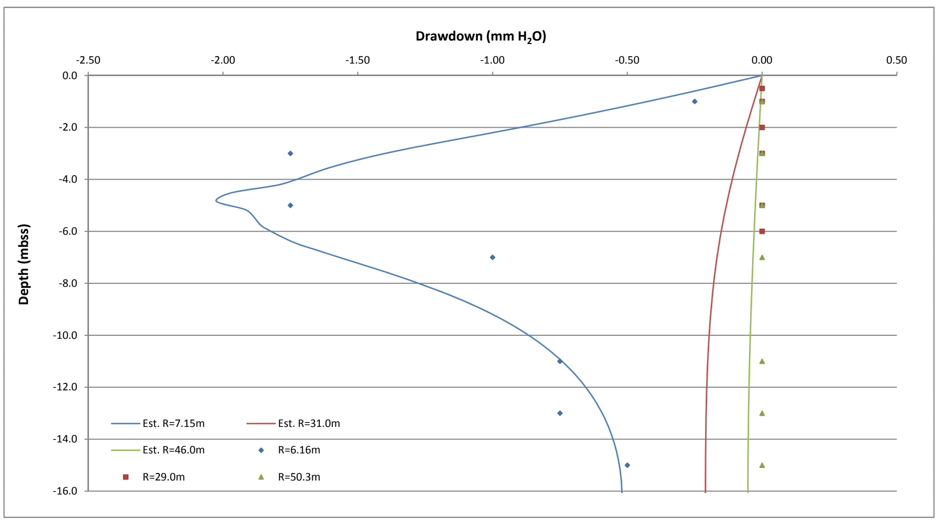
K_{gx} (m/s)	**KR** (-)	**KD** (-)
1.50E-04	0.25	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m (mm H_2O)	**CMT 147** R=31.0m (mm H_2O)	**CMT 143** R=46.0m (mm H_2O)
-0.5	-	0	-
-1	-0.25	0	0
-2	-	0	-
-3	-1.75	0	0
-5	-1.75	0	0
-6	-	0	-
-7	-1.00	-	0
-11	-0.75	-	0
-13	-0.75	-	0
-15	-0.50	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.27	-0.02	0.00	0.00
-1	-0.41	-0.03	-0.01	0.03
-2	-0.87	-0.06	-0.01	0.00
-3	-1.36	-0.08	-0.02	0.16
-5	-2.02	-0.13	-0.02	0.09
-6	-1.80	-0.15	-0.03	0.02
-7	-1.54	-0.17	-0.03	0.29
-11	-0.74	-0.20	-0.05	0.00
-13	-0.60	-0.21	-0.05	0.03
-15	-0.53	-0.21	-0.05	0.00
			Total	0.63



NOTES:

- i.e. -R=7.15m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	220909-B-ANG-4	FLOW RATE 3
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (^{o}C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	Flux (m/s)
1.32E-02	2.00E-02
1.65E-02	2.50E-02
1.89E-02	2.86E-02
1.65E-02	2.50E-02
1.42E-02	2.14E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

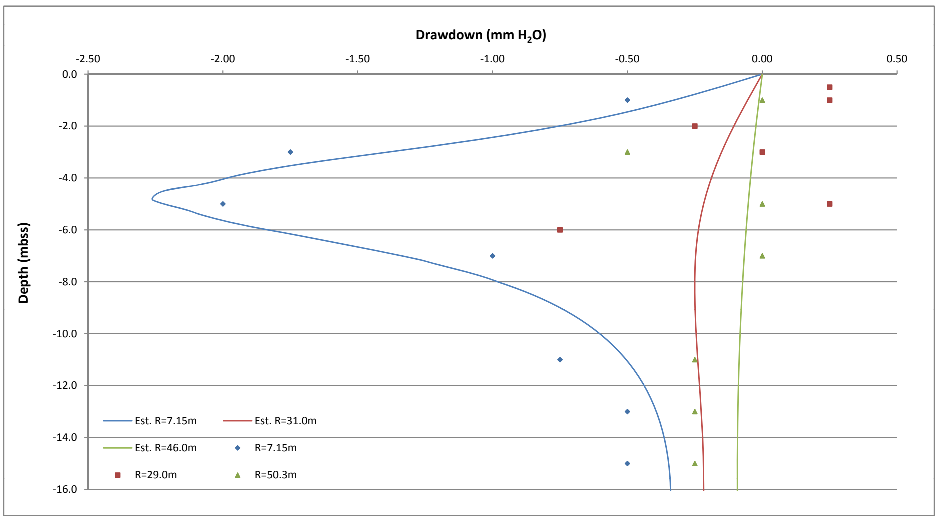
K_{gx} (m/s)	KR (-)	KD (-)
2.75E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	CMT 144 R=7.15m (mm H_2O)	CMT 147 R=31.0m (mm H_2O)	CMT 143 R=46.0m (mm H_2O)
-0.5	-	0.25	-
-1	-0.50	0.25	0
-2	-	-0.25	-
-3	-1.75	0	-0.5
-5	-2.00	0.25	0
-6	-	-0.75	-
-7	-1.00	-	0
-11	-0.75	-	-0.25
-13	-0.50	-	-0.25
-15	-0.50	-	-0.25

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	CMT 144 R=7.15m TH (mm H_2O)	CMT 147 R=31.0m TH (mm H_2O)	CMT 143 R=46.0m TH (mm H_2O)	SLS (mm^2 H_2O)
-0.5	-0.21	-0.04	-0.01	0.08
-1	-0.32	-0.05	-0.01	0.13
-2	-0.72	-0.10	-0.02	0.02
-3	-1.32	-0.15	-0.03	0.43
-5	-2.26	-0.21	-0.05	0.29
-6	-1.76	-0.24	-0.06	0.26
-7	-1.29	-0.25	-0.07	0.09
-11	-0.51	-0.24	-0.09	0.09
-13	-0.40	-0.23	-0.09	0.04
-15	-0.34	-0.22	-0.09	0.05
			Total	1.46



NOTES:
- i.e. -R=7.15m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**220909-B-ANG-4**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.32E-02	2.00E-02
1.65E-02	2.50E-02
1.89E-02	2.86E-02
1.65E-02	2.50E-02
1.42E-02	2.14E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

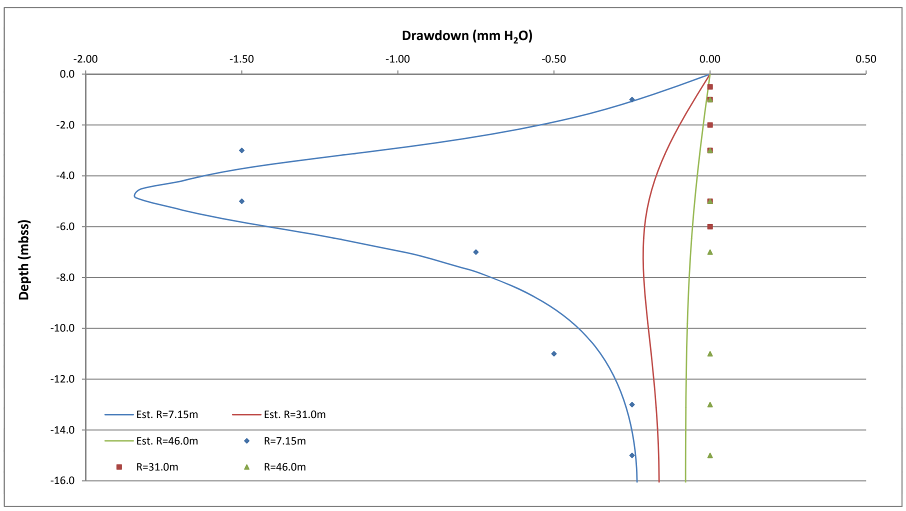
K_{gx} (m/s)	**A_{gr}** (-)	**KD** (-)
3.50E-04	0.075	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m (mm H_2O)	**CMT 147** R=31.0m (mm H_2O)	**CMT 143** R=46.0m (mm H_2O)
-0.5	-	0	-
-1	-0.25	0	0
-2	-	0	-
-3	-1.50	0	0
-5	-1.50	0	0
-6	-	0	-
-7	-0.75	-	0
-11	-0.50	-	0
-13	-0.25	-	0
-15	-0.25	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.15	-0.03	-0.01	0.00
-1	-0.22	-0.05	-0.01	0.00
-2	-0.52	-0.09	-0.02	0.01
-3	-1.00	-0.14	-0.03	0.27
-5	-1.84	-0.19	-0.05	0.16
-6	-1.35	-0.21	-0.06	0.04
-7	-0.94	-0.21	-0.06	0.04
-11	-0.35	-0.19	-0.08	0.03
-13	-0.27	-0.17	-0.08	0.01
-15	-0.24	-0.16	-0.08	0.01
			Total	0.57



NOTES:

- i.e. -R=7.15m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**220909-B-ANG-4**	**FLOW RATE 5**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.32E-02	2.00E-02
1.65E-02	2.50E-02
1.89E-02	2.86E-02
1.65E-02	2.50E-02
1.42E-02	2.14E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

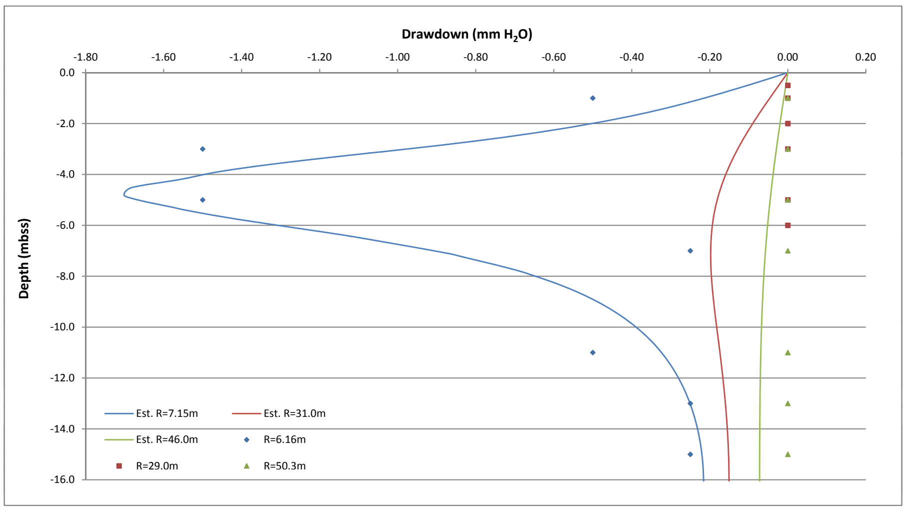
K_{gx} (m/s)	A_{gr} (-)	**KD** (-)
3.25E-04	0.075	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m (mm H_2O)	**CMT 147** R=31.0m (mm H_2O)	**CMT 143** R=46.0m (mm H_2O)
-0.5	-	0	-
-1	-0.50	0	0
-2	-	0	-
-3	-1.50	0	0
-5	-1.50	0	0
-6	-	0	-
-7	-0.25	-	0
-11	-0.50	-	0
-13	-0.25	-	0
-15	-0.25	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.13	-0.03	-0.01	0.00
-1	-0.21	-0.04	-0.01	0.09
-2	-0.48	-0.09	-0.02	0.01
-3	-0.92	-0.13	-0.03	0.35
-5	-1.70	-0.18	-0.04	0.07
-6	-1.25	-0.19	-0.05	0.04
-7	-0.87	-0.20	-0.06	0.39
-11	-0.33	-0.17	-0.07	0.04
-13	-0.25	-0.16	-0.07	0.01
-15	-0.22	-0.15	-0.07	0.01
			Total	0.99



NOTES:

- i.e. -R=7.15m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test: **220909-B-ANG-5** **FLOW RATE 1**

Client: Syncrude Canada Ltd.

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.18E-02	1.79E-02
1.53E-02	2.32E-02
1.89E-02	2.86E-02
1.51E-02	2.29E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

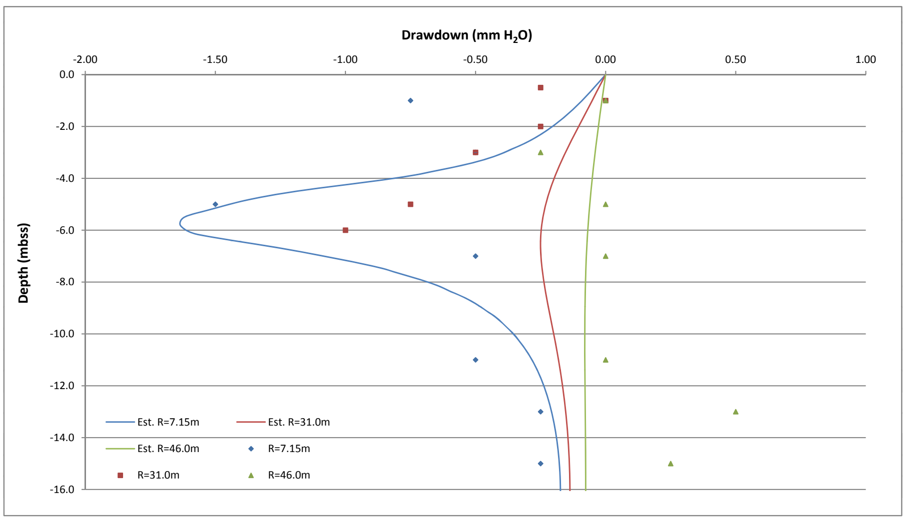
K_{gx} (m/s)	A_{gr} (-)	KD (-)
4.00E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m (mm H_2O)	**CMT 147** R=31.0m (mm H_2O)	**CMT 143** R=46.0m (mm H_2O)
-0.5	-	-0.25	-
-1	-0.75	0	0
-2	-	-0.25	-
-3	-0.50	-0.5	-0.25
-5	-1.50	-0.75	0
-6	-	-1	-
-7	-0.50	-	0
-11	-0.50	-	0
-13	-0.25	-	0.5
-15	-0.25	-	0.25

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.06	-0.03	-0.01	0.05
-1	-0.09	-0.05	-0.01	0.44
-2	-0.20	-0.10	-0.03	0.02
-3	-0.37	-0.15	-0.04	0.08
-5	-1.38	-0.23	-0.06	0.29
-6	-1.58	-0.25	-0.07	0.56
-7	-1.03	-0.25	-0.07	0.29
-11	-0.28	-0.18	-0.08	0.05
-13	-0.21	-0.15	-0.08	0.34
-15	-0.18	-0.14	-0.08	0.11
			Total	2.24



NOTES:

- i.e. -R=7.15m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**220909-B-ANG-5**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

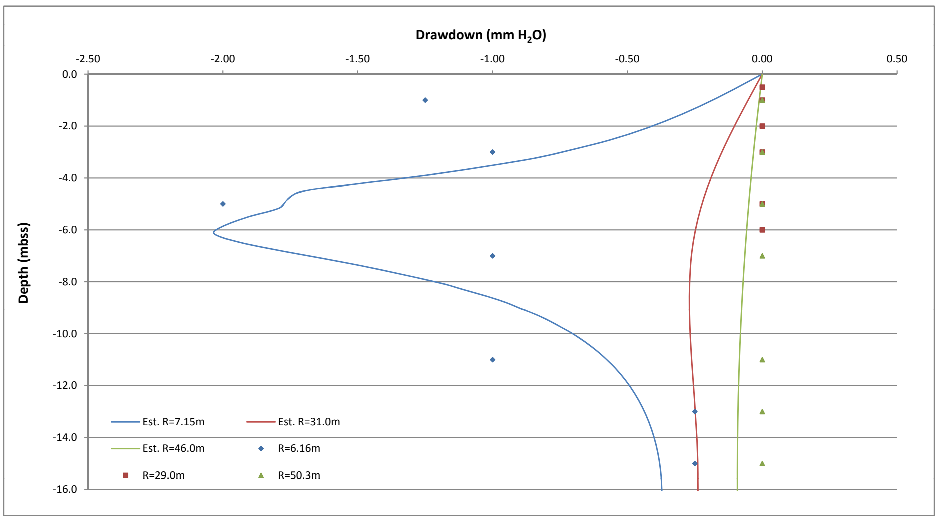
K_{gx} (m/s)	**KR** (-)	**KD** (-)
2.50E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m (mm H_2O)	**CMT 147** R=31.0m (mm H_2O)	**CMT 143** R=46.0m (mm H_2O)
-0.5	-	0	-
-1	-1.25	0	0
-2	-	0	-
-3	-1.00	0	0
-5	-2.00	0	0
-6	-	0	-
-7	-1.00	-	0
-11	-1.00	-	0
-13	-0.25	-	0
-15	-0.25	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.12	-0.03	-0.01	0.00
-1	-0.18	-0.05	-0.01	1.15
-2	-0.39	-0.10	-0.02	0.01
-3	-0.70	-0.15	-0.03	0.11
-5	-1.76	-0.22	-0.05	0.11
-6	-2.03	-0.25	-0.06	0.06
-7	-1.63	-0.26	-0.07	0.40
-11	-0.58	-0.26	-0.08	0.18
-13	-0.44	-0.25	-0.09	0.04
-15	-0.38	-0.24	-0.09	0.02
			Total	2.09



NOTES:
- i.e. -R=7.15m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**220909-B-ANG-5**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.18E-02	1.79E-02
1.53E-02	2.32E-02
1.89E-02	2.86E-02
1.51E-02	2.29E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

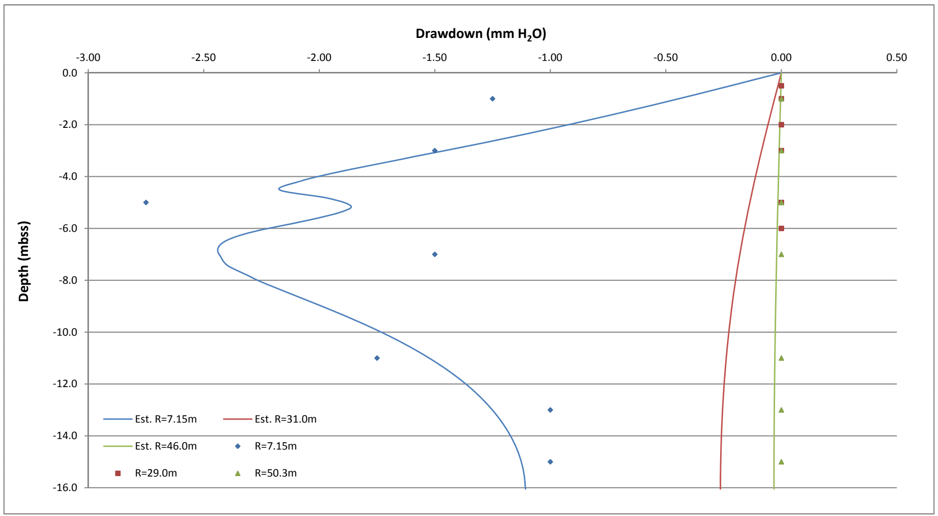
K_{gx} (m/s)	**KR** (-)	**KD** (-)
9.00E-05	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m ($mm\ H_2O$)	**CMT 147** R=31.0m ($mm\ H_2O$)	**CMT 143** R=46.0m ($mm\ H_2O$)
-0.5	-	0	-
-1	-1.25	0	0
-2	-	0	-
-3	-1.50	0	0
-5	-2.75	0	0
-6	-	0	-
-7	-1.50	-	0
-11	-1.75	-	0
-13	-1.00	-	0
-15	-1.00	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.29	-0.02	0.00	0.00
-1	-0.43	-0.03	0.00	0.67
-2	-0.89	-0.06	-0.01	0.00
-3	-1.40	-0.08	-0.01	0.02
-5	-1.96	-0.13	-0.01	0.65
-6	-2.29	-0.16	-0.02	0.03
-7	-2.43	-0.18	-0.02	0.86
-11	-1.53	-0.24	-0.03	0.05
-13	-1.26	-0.25	-0.03	0.07
-15	-1.12	-0.26	-0.03	0.02
			Total	2.36



NOTES:

- i.e. -R=7.15m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test: **220909-B-ANG-5** **FLOW RATE 4**

Client: Syncrude Canada Ltd.

Test Date	22-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.18E-02	1.79E-02
1.53E-02	2.32E-02
1.89E-02	2.86E-02
1.51E-02	2.29E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

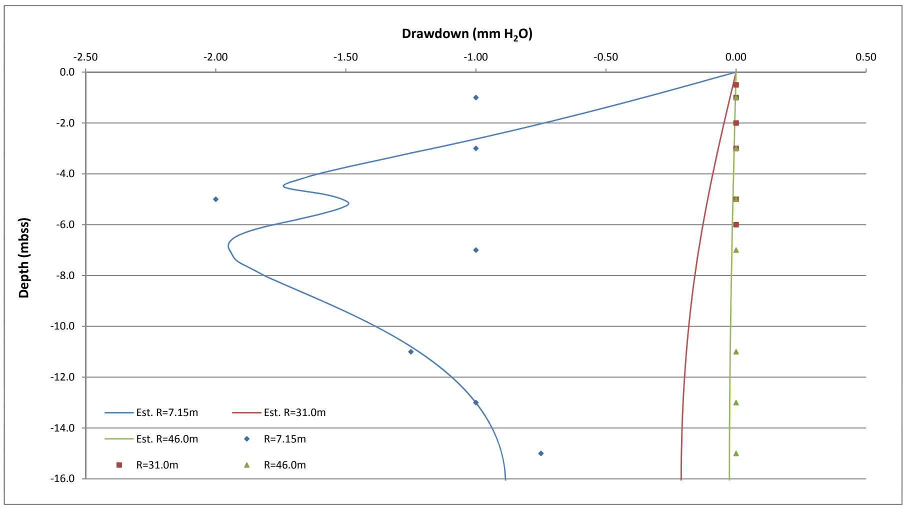
K_{gx} (m/s)	**A_{gr}** (-)	**KD** (-)
9.00E-05	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m (mm H_2O)	**CMT 147** R=31.0m (mm H_2O)	**CMT 143** R=46.0m (mm H_2O)
-0.5	-	0	-
-1	-1.00	0	0
-2	-	0	-
-3	-1.00	0	0
-5	-2.00	0	0
-6	-	0	-
-7	-1.00	-	0
-11	-1.25	-	0
-13	-1.00	-	0
-15	-0.75	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.23	-0.02	0.00	0.00
-1	-0.34	-0.02	0.00	0.43
-2	-0.71	-0.04	0.00	0.00
-3	-1.12	-0.07	-0.01	0.02
-5	-1.57	-0.11	-0.01	0.20
-6	-1.83	-0.13	-0.01	0.02
-7	-1.94	-0.15	-0.02	0.88
-11	-1.22	-0.19	-0.02	0.00
-13	-1.01	-0.20	-0.02	0.00
-15	-0.90	-0.21	-0.03	0.02
			Total	1.58



NOTES:

- i.e. -R=7.15m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test: **220909-B-ANG-5** **FLOW RATE 5**

Client: Syncrude Canada Ltd.

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.18E-02	1.79E-02
1.53E-02	2.32E-02
1.89E-02	2.86E-02
1.51E-02	2.29E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

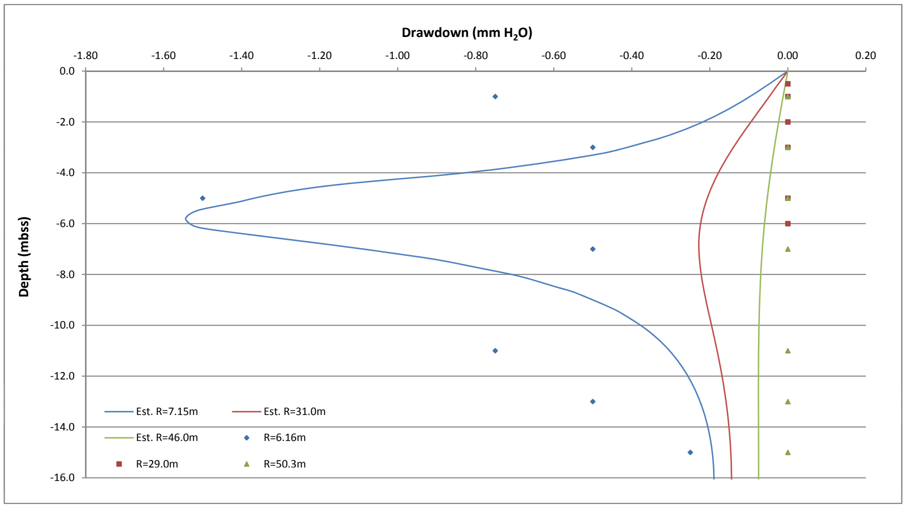
K_{gx} (m/s)	**A_{gr}** (-)	**KD** (-)
3.75E-04	0.05	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m (mm H_2O)	**CMT 147** R=31.0m (mm H_2O)	**CMT 143** R=46.0m (mm H_2O)
-0.5	-	0	-
-1	-0.75	0	0
-2	-	0	-
-3	-0.50	0	0
-5	-1.50	0	0
-6	-	0	-
-7	-0.50	-	0
-11	-0.75	-	0
-13	-0.50	-	0
-15	-0.25	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.06	-0.03	-0.01	0.00
-1	-0.09	-0.05	-0.01	0.43
-2	-0.21	-0.09	-0.02	0.01
-3	-0.39	-0.14	-0.03	0.03
-5	-1.32	-0.20	-0.05	0.08
-6	-1.51	-0.23	-0.06	0.05
-7	-1.04	-0.23	-0.07	0.30
-11	-0.30	-0.18	-0.07	0.20
-13	-0.23	-0.16	-0.08	0.08
-15	-0.19	-0.15	-0.08	0.01
			Total	1.19



NOTES:

- i.e. -R=7.15m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**220909-B-ANG-6**	**FLOW RATE 1**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
4.72E-03	7.14E-03
9.44E-03	1.43E-02
1.36E-02	2.05E-02
9.32E-03	1.41E-02
4.72E-03	7.14E-03

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

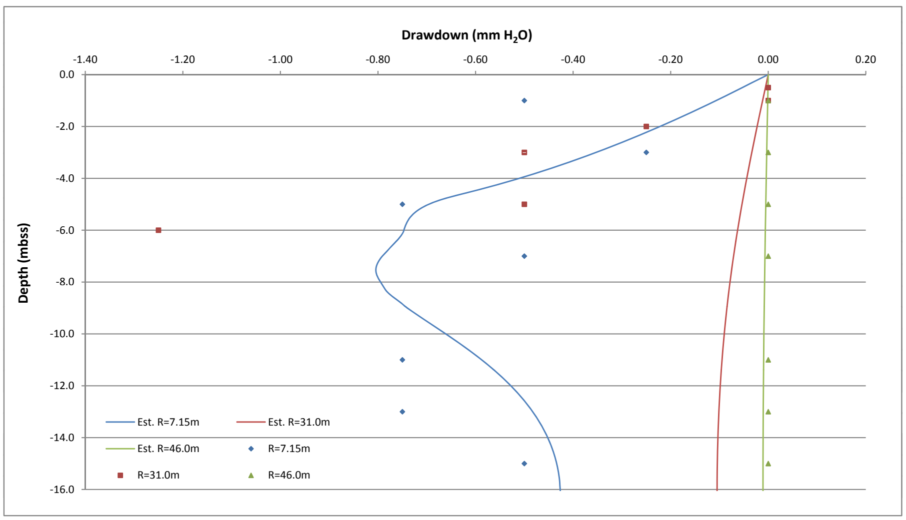
K_{gx} (m/s)	A_{gr} (-)	KD (-)
7.00E-05	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m (mm H_2O)	**CMT 147** R=31.0m (mm H_2O)	**CMT 143** R=46.0m (mm H_2O)
-0.5	-	0	-
-1	-0.50	0	0
-2	-	-0.25	-
-3	-0.25	-0.5	0
-5	-0.75	-0.5	0
-6	-	-1.25	-
-7	-0.50	-	0
-11	-0.75	-	0
-13	-0.75	-	0
-15	-0.50	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.07	-0.01	0.00	0.00
-1	-0.10	-0.01	0.00	0.16
-2	-0.21	-0.02	0.00	0.05
-3	-0.34	-0.03	0.00	0.01
-5	-0.67	-0.05	0.00	0.21
-6	-0.75	-0.06	-0.01	1.41
-7	-0.80	-0.07	-0.01	0.09
-11	-0.59	-0.09	-0.01	0.03
-13	-0.49	-0.10	-0.01	0.07
-15	-0.43	-0.10	-0.01	0.00
			Total	2.02



NOTES:

- i.e. -R=7.15m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**220909-B-ANG-6**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

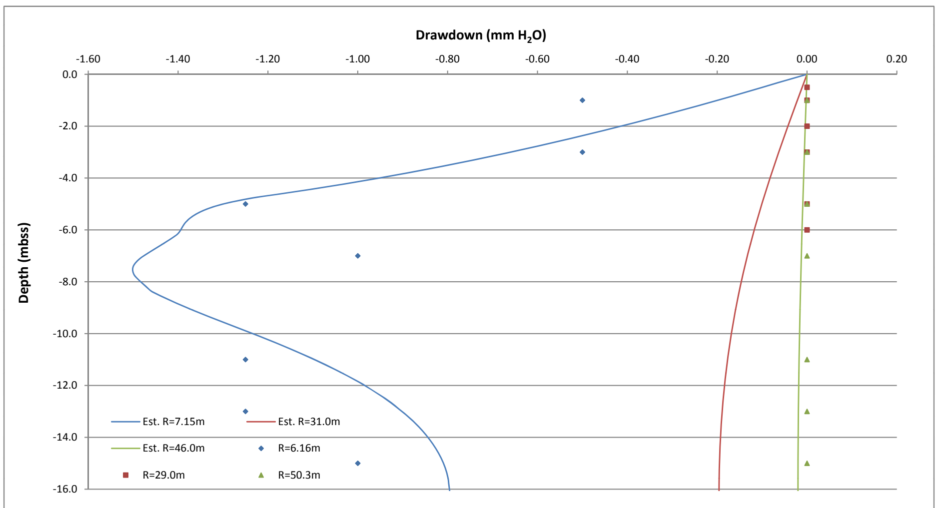
K_{gx} (m/s)	**KR** (-)	**KD** (-)
7.00E-05	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m (mm H_2O)	**CMT 147** R=31.0m (mm H_2O)	**CMT 143** R=46.0m (mm H_2O)
-0.5	-	0	-
-1	-0.50	0	0
-2	-	0	-
-3	-0.50	0	0
-5	-1.25	0	0
-6	-	0	-
-7	-1.00	-	0
-11	-1.25	-	0
-13	-1.25	-	0
-15	-1.00	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.13	-0.01	0.00	0.00
-1	-0.19	-0.02	0.00	0.09
-2	-0.40	-0.04	0.00	0.00
-3	-0.63	-0.06	-0.01	0.02
-5	-1.26	-0.10	-0.01	0.01
-6	-1.40	-0.12	-0.01	0.01
-7	-1.48	-0.13	-0.01	0.24
-11	-1.10	-0.18	-0.02	0.02
-13	-0.91	-0.19	-0.02	0.12
-15	-0.81	-0.20	-0.02	0.04
			Total	0.56



NOTES:
- i.e. -R=7.15m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**220909-B-ANG-6**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
4.72E-03	7.14E-03
9.44E-03	1.43E-02
1.36E-02	2.05E-02
9.32E-03	1.41E-02
4.72E-03	7.14E-03

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

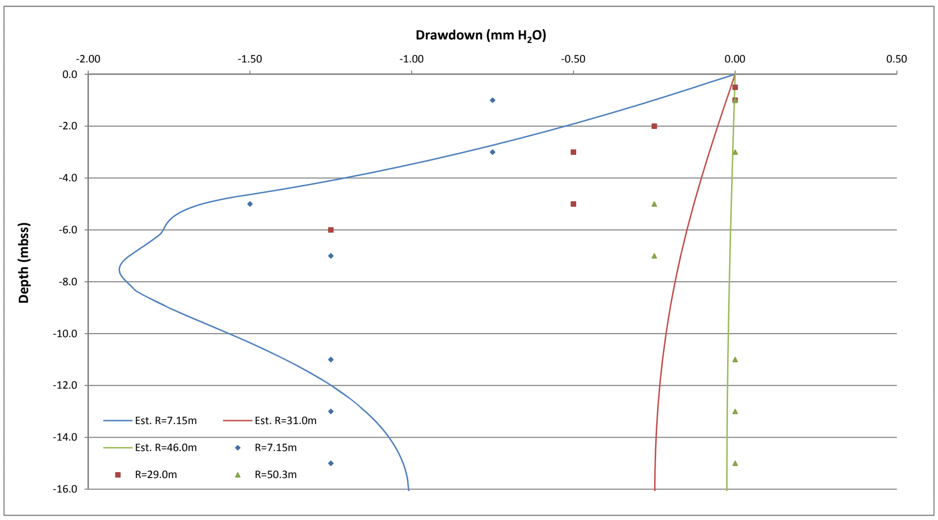
K_{gx} (m/s)	**KR** (-)	**KD** (-)
7.00E-05	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m ($mm H_2O$)	**CMT 147** R=31.0m ($mm H_2O$)	**CMT 143** R=46.0m ($mm H_2O$)
-0.5	-	0	-
-1	-0.75	0	0
-2	-	-0.25	-
-3	-0.75	-0.5	0
-5	-1.50	-0.5	-0.25
-6	-	-1.25	-
-7	-1.25	-	-0.25
-11	-1.25	-	0
-13	-1.25	-	0
-15	-1.25	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm H_2O$)	**CMT 147** R=31.0m TH ($mm H_2O$)	**CMT 143** R=46.0m TH ($mm H_2O$)	**SLS** ($mm^2 H_2O$)
-0.5	-0.16	-0.02	0.00	0.00
-1	-0.25	-0.03	0.00	0.25
-2	-0.51	-0.05	0.00	0.04
-3	-0.80	-0.08	-0.01	0.01
-5	-1.60	-0.12	-0.01	0.21
-6	-1.78	-0.15	-0.01	1.21
-7	-1.88	-0.17	-0.02	0.46
-11	-1.39	-0.22	-0.02	0.02
-13	-1.15	-0.24	-0.02	0.01
-15	-1.02	-0.25	-0.03	0.05
			Total	2.26



NOTES:
- i.e. -R=7.15m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**220909-B-ANG-6**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
4.72E-03	7.14E-03
9.44E-03	1.43E-02
1.36E-02	2.05E-02
9.32E-03	1.41E-02
4.72E-03	7.14E-03

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

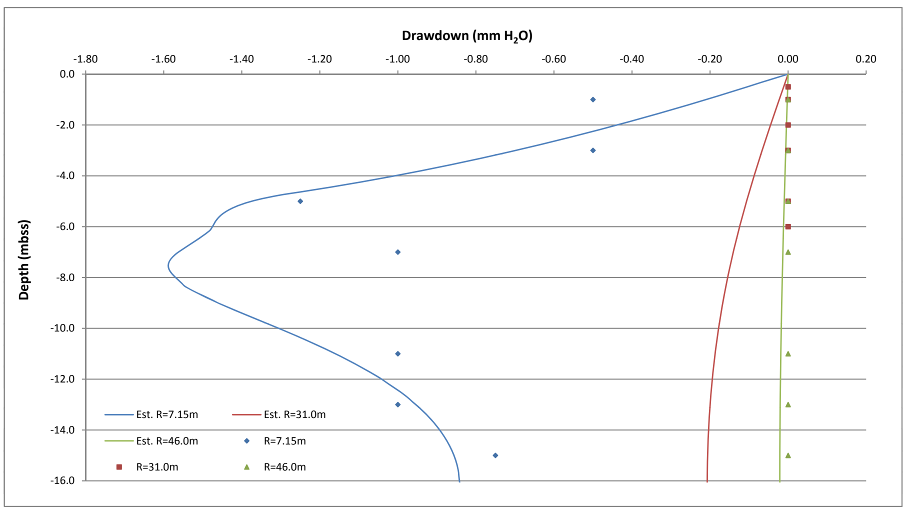
K_{gx} (m/s)	**A_{gr}** (-)	**KD** (-)
7.00E-05	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m (mm H_2O)	**CMT 147** R=31.0m (mm H_2O)	**CMT 143** R=46.0m (mm H_2O)
-0.5	-	0	-
-1	-0.50	0	0
-2	-	0	-
-3	-0.50	0	0
-5	-1.25	0	0
-6	-	0	-
-7	-1.00	-	0
-11	-1.00	-	0
-13	-1.00	-	0
-15	-0.75	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.14	-0.01	0.00	0.00
-1	-0.21	-0.02	0.00	0.09
-2	-0.42	-0.04	0.00	0.00
-3	-0.67	-0.06	-0.01	0.03
-5	-1.33	-0.10	-0.01	0.02
-6	-1.48	-0.13	-0.01	0.02
-7	-1.57	-0.14	-0.01	0.33
-11	-1.16	-0.19	-0.02	0.03
-13	-0.96	-0.20	-0.02	0.00
-15	-0.85	-0.21	-0.02	0.01
			Total	0.52



NOTES:
- i.e. -R=7.15m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**220909-B-ANG-6**	**FLOW RATE 5**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
4.72E-03	7.14E-03
9.44E-03	1.43E-02
1.36E-02	2.05E-02
9.32E-03	1.41E-02
4.72E-03	7.14E-03

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

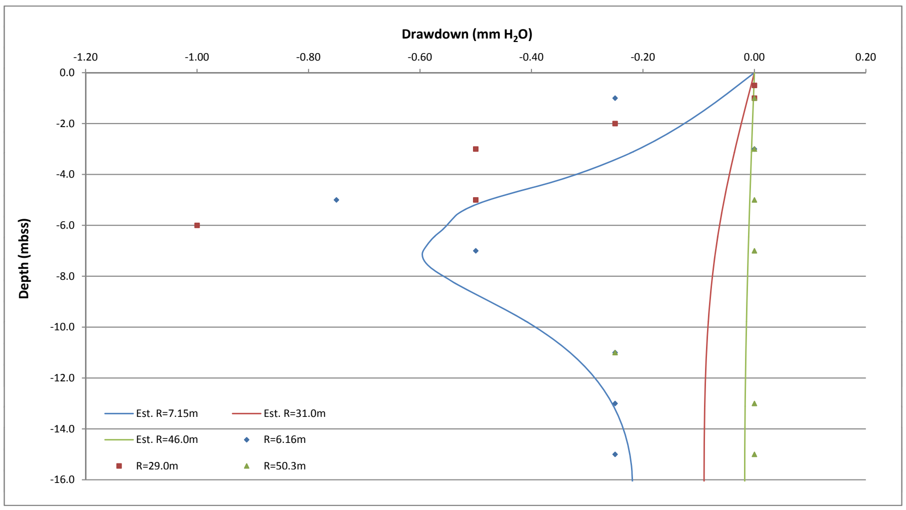
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.50E-04	0.25	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m ($mm\ H_2O$)	**CMT 147** R=31.0m ($mm\ H_2O$)	**CMT 143** R=46.0m ($mm\ H_2O$)
-0.5	-	0	-
-1	-0.25	0	0
-2	-	-0.25	-
-3	0.00	-0.5	0
-5	-0.75	-0.5	0
-6	-	-1	-
-7	-0.50	-	0
-11	-0.25	-	-0.25
-13	-0.25	-	0
-15	-0.25	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.04	-0.01	0.00	0.00
-1	-0.06	-0.01	0.00	0.04
-2	-0.12	-0.02	0.00	0.05
-3	-0.20	-0.03	0.00	0.04
-5	-0.45	-0.05	-0.01	0.29
-6	-0.56	-0.06	-0.01	0.88
-7	-0.60	-0.07	-0.01	0.01
-11	-0.33	-0.09	-0.02	0.06
-13	-0.26	-0.09	-0.02	0.00
-15	-0.22	-0.09	-0.02	0.00
			Total	1.37



NOTES:
- i.e. -R=7.15m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**220909-B-ANG-7**	**FLOW RATE 1**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.65E-02	2.50E-02
1.77E-02	2.68E-02
1.89E-02	2.86E-02
1.77E-02	2.68E-02
1.65E-02	2.50E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

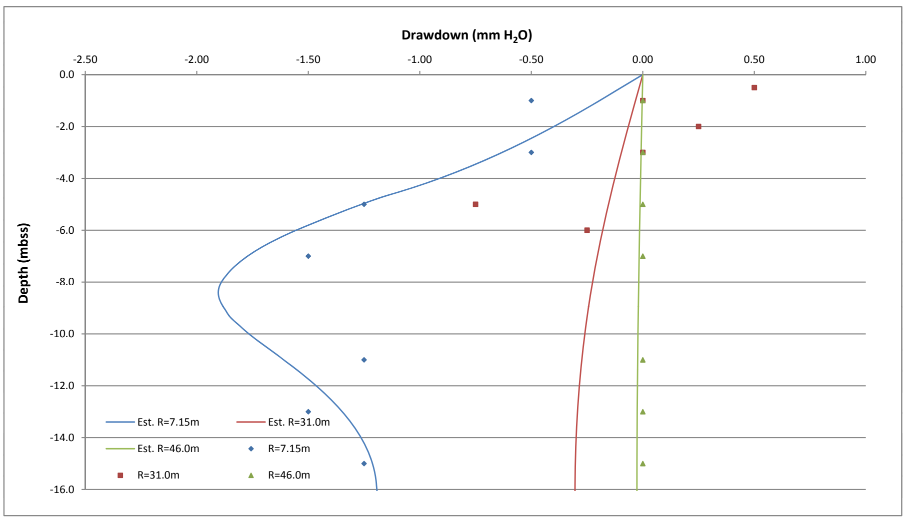
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.00E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m (mm H_2O)	**CMT 147** R=31.0m (mm H_2O)	**CMT 143** R=46.0m (mm H_2O)
-0.5	-	0.5	-
-1	-0.50	0	0
-2	-	0.25	-
-3	-0.50	0	0
-5	-1.25	-0.75	0
-6	-	-0.25	-
-7	-1.50	-	0
-11	-1.25	-	0
-13	-1.50	-	0
-15	-1.25	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.13	-0.02	0.00	0.27
-1	-0.19	-0.03	0.00	0.10
-2	-0.38	-0.06	0.00	0.10
-3	-0.61	-0.09	-0.01	0.02
-5	-1.21	-0.15	-0.01	0.36
-6	-1.59	-0.18	-0.01	0.00
-7	-1.79	-0.21	-0.02	0.08
-11	-1.61	-0.27	-0.02	0.13
-13	-1.36	-0.29	-0.02	0.02
-15	-1.21	-0.30	-0.03	0.00
			Total	1.09



NOTES:
- i.e. -R=7.15m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**220909-B-ANG-7**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

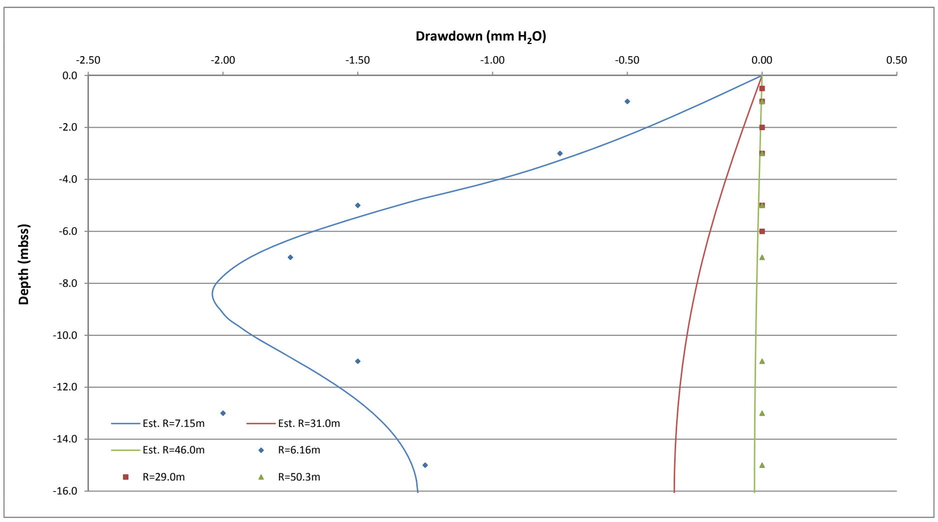
K_{gx} (m/s)	**KR** (-)	**KD** (-)
1.00E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m ($mm\ H_2O$)	**CMT 147** R=31.0m ($mm\ H_2O$)	**CMT 143** R=46.0m ($mm\ H_2O$)
-0.5	-	0	-
-1	-0.50	0	0
-2	-	0	-
-3	-0.75	0	0
-5	-1.50	0	0
-6	-	0	-
-7	-1.75	-	0
-11	-1.50	-	0
-13	-2.00	-	0
-15	-1.25	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.13	-0.02	0.00	0.00
-1	-0.20	-0.03	0.00	0.09
-2	-0.41	-0.07	-0.01	0.00
-3	-0.65	-0.10	-0.01	0.02
-5	-1.30	-0.16	-0.01	0.07
-6	-1.70	-0.20	-0.02	0.04
-7	-1.92	-0.22	-0.02	0.03
-11	-1.73	-0.29	-0.02	0.05
-13	-1.45	-0.31	-0.03	0.30
-15	-1.29	-0.32	-0.03	0.00
			Total	0.60



NOTES:
- i.e. -R=7.15m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	220909-B-ANG-7	FLOW RATE 3
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	Flux (m/s)
1.65E-02	2.50E-02
1.77E-02	2.68E-02
1.89E-02	2.86E-02
1.77E-02	2.68E-02
1.65E-02	2.50E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

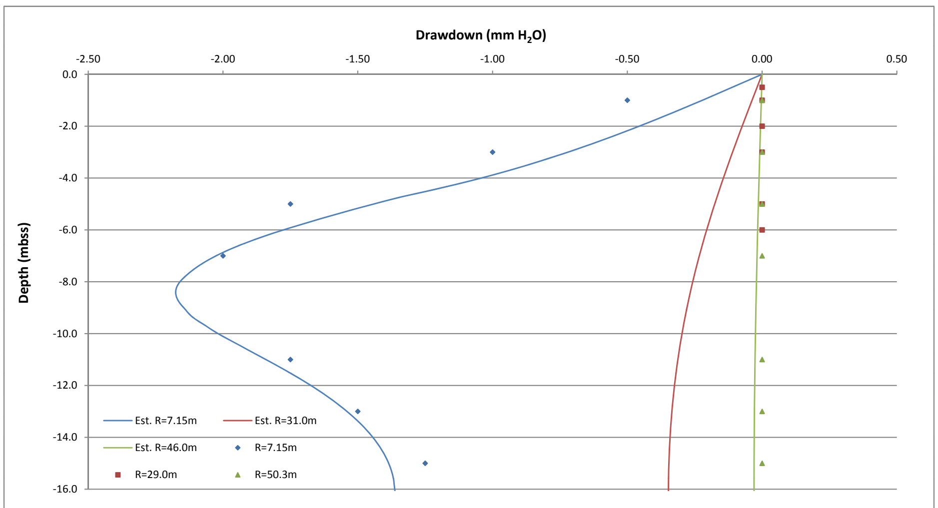
K_{gx} (m/s)	KR (-)	KD (-)
1.00E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	CMT 144 R=7.15m ($mm\ H_2O$)	CMT 147 R=31.0m ($mm\ H_2O$)	CMT 143 R=46.0m ($mm\ H_2O$)
-0.5	-	0	-
-1	-0.50	0	0
-2	-	0	-
-3	-1.00	0	0
-5	-1.75	0	0
-6	-	0	-
-7	-2.00	-	0
-11	-1.75	-	0
-13	-1.50	-	0
-15	-1.25	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	CMT 144 R=7.15m TH ($mm\ H_2O$)	CMT 147 R=31.0m TH ($mm\ H_2O$)	CMT 143 R=46.0m TH ($mm\ H_2O$)	SLS ($mm^2\ H_2O$)
-0.5	-0.14	-0.02	0.00	0.00
-1	-0.21	-0.04	0.00	0.08
-2	-0.44	-0.07	-0.01	0.01
-3	-0.69	-0.11	-0.01	0.11
-5	-1.39	-0.17	-0.01	0.16
-6	-1.82	-0.21	-0.02	0.04
-7	-2.04	-0.24	-0.02	0.00
-11	-1.84	-0.31	-0.03	0.01
-13	-1.55	-0.33	-0.03	0.00
-15	-1.38	-0.35	-0.03	0.02
			Total	0.43



NOTES:
- i.e. -R=7.15m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**220909-B-ANG-7**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.65E-02	2.50E-02
1.77E-02	2.68E-02
1.89E-02	2.86E-02
1.77E-02	2.68E-02
1.65E-02	2.50E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

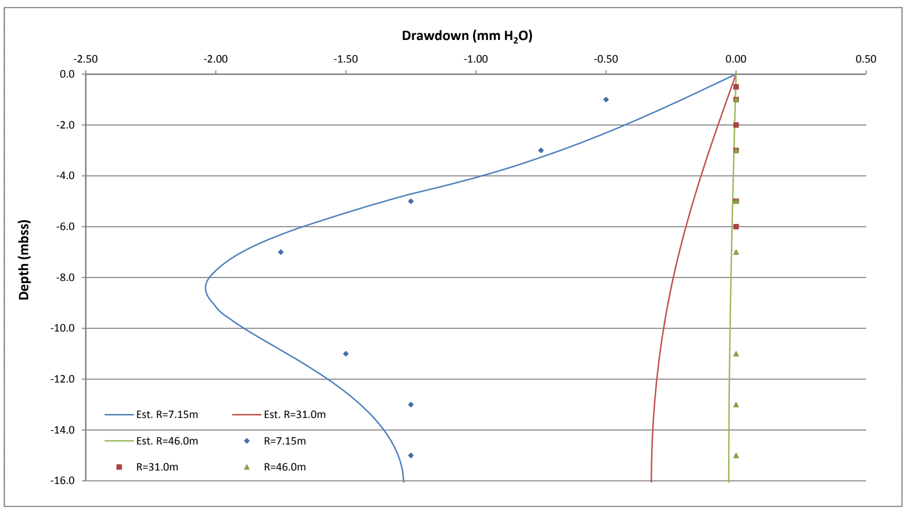
K_{gx} (m/s)	A_{gr} (-)	**KD** (-)
1.00E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m ($mm\ H_2O$)	**CMT 147** R=31.0m ($mm\ H_2O$)	**CMT 143** R=46.0m ($mm\ H_2O$)
-0.5	-	0	-
-1	-0.50	0	0
-2	-	0	-
-3	-0.75	0	0
-5	-1.25	0	0
-6	-	0	-
-7	-1.75	-	0
-11	-1.50	-	0
-13	-1.25	-	0
-15	-1.25	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.13	-0.02	0.00	0.00
-1	-0.20	-0.03	0.00	0.09
-2	-0.41	-0.07	-0.01	0.00
-3	-0.65	-0.10	-0.01	0.02
-5	-1.30	-0.16	-0.01	0.03
-6	-1.70	-0.20	-0.02	0.04
-7	-1.92	-0.22	-0.02	0.03
-11	-1.73	-0.29	-0.02	0.05
-13	-1.45	-0.31	-0.03	0.04
-15	-1.29	-0.32	-0.03	0.00
			Total	0.31



NOTES:
- i.e. -R=7.15m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**220909-B-ANG-7**	**FLOW RATE 5**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (^{o}C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.65E-02	2.50E-02
1.77E-02	2.68E-02
1.89E-02	2.86E-02
1.77E-02	2.68E-02
1.65E-02	2.50E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

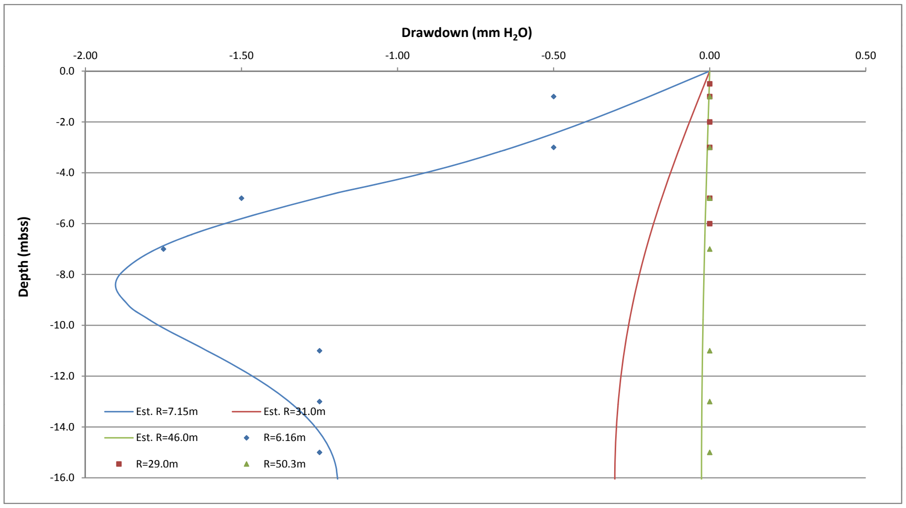
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.00E-04	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m (mm H_2O)	**CMT 147** R=31.0m (mm H_2O)	**CMT 143** R=46.0m (mm H_2O)
-0.5	-	0	-
-1	-0.50	0	0
-2	-	0	-
-3	-0.50	0	0
-5	-1.50	0	0
-6	-	0	-
-7	-1.75	-	0
-11	-1.25	-	0
-13	-1.25	-	0
-15	-1.25	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.13	-0.02	0.00	0.00
-1	-0.19	-0.03	0.00	0.10
-2	-0.38	-0.06	0.00	0.00
-3	-0.61	-0.09	-0.01	0.02
-5	-1.21	-0.15	-0.01	0.10
-6	-1.59	-0.18	-0.01	0.03
-7	-1.79	-0.21	-0.02	0.00
-11	-1.61	-0.27	-0.02	0.13
-13	-1.36	-0.29	-0.02	0.01
-15	-1.21	-0.30	-0.03	0.00
			Total	0.41



NOTES:

- i.e. -R=7.15m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test: **220909-B-ANG-8** **FLOW RATE 1**

Client: Syncrude Canada Ltd.

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
8.73E-03	1.32E-02
1.37E-02	2.07E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

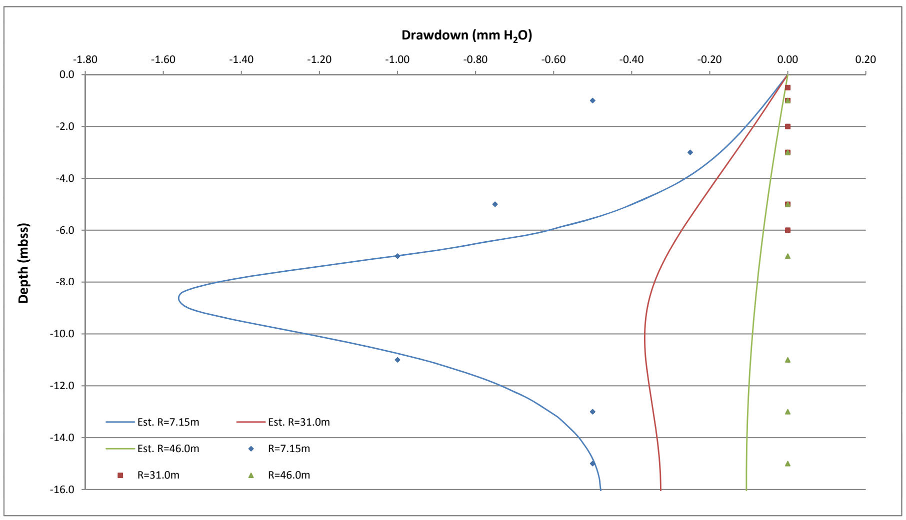
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.00E-04	0.075	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m ($mm H_2O$)	**CMT 147** R=31.0m ($mm H_2O$)	**CMT 143** R=46.0m ($mm H_2O$)
-0.5	-	0	-
-1	-0.50	0	0
-2	-	0	-
-3	-0.25	0	0
-5	-0.75	0	0
-6	-	0	-
-7	-1.00	-	0
-11	-1.00	-	0
-13	-0.50	-	0
-15	-0.50	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm H_2O$)	**CMT 147** R=31.0m TH ($mm H_2O$)	**CMT 143** R=46.0m TH ($mm H_2O$)	**SLS** ($mm^2 H_2O$)
-0.5	-0.03	-0.03	-0.01	0.00
-1	-0.05	-0.04	-0.01	0.20
-2	-0.10	-0.09	-0.02	0.01
-3	-0.17	-0.13	-0.03	0.02
-5	-0.38	-0.22	-0.05	0.19
-6	-0.65	-0.28	-0.06	0.08
-7	-1.06	-0.31	-0.07	0.01
-11	-0.94	-0.36	-0.10	0.01
-13	-0.62	-0.35	-0.10	0.02
-15	-0.49	-0.33	-0.11	0.01
			Total	0.56



NOTES:

- i.e. -R=7.15m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	220909-B-ANG-8	FLOW RATE 2
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	Flux (m/s)
1.13E-02	1.71E-02
1.55E-02	2.34E-02
1.89E-02	2.86E-02
1.53E-02	2.32E-02
1.18E-02	1.79E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

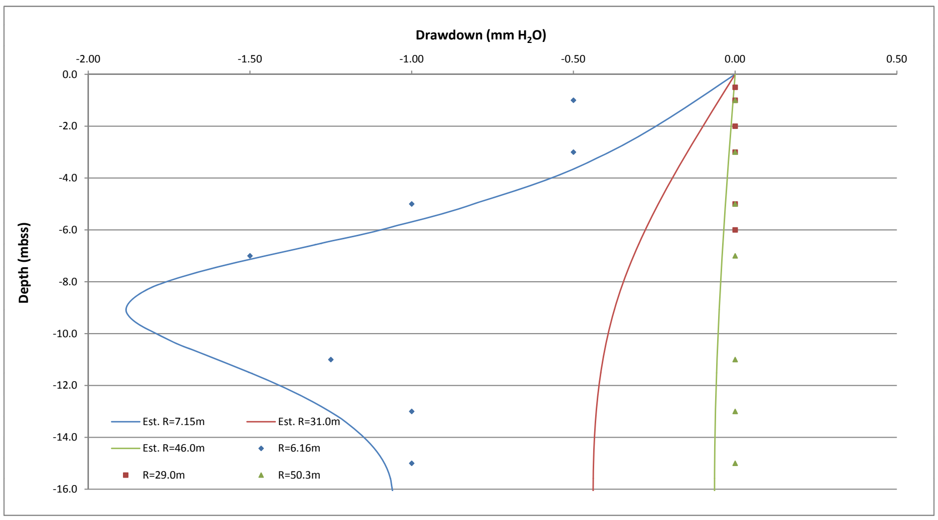
K_{gx} (m/s)	KR (-)	KD (-)
1.25E-04	0.25	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	CMT 144 R=7.15m (mm H_2O)	CMT 147 R=31.0m (mm H_2O)	CMT 143 R=46.0m (mm H_2O)
-0.5	-	0	-
-1	-0.50	0	0
-2	-	0	-
-3	-0.50	0	0
-5	-1.00	0	0
-6	-	0	-
-7	-1.50	-	0
-11	-1.25	-	0
-13	-1.00	-	0
-15	-1.00	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	CMT 144 R=7.15m TH (mm H_2O)	CMT 147 R=31.0m TH (mm H_2O)	CMT 143 R=46.0m TH (mm H_2O)	SLS (mm^2 H_2O)
-0.5	-0.08	-0.03	0.00	0.00
-1	-0.12	-0.05	-0.01	0.15
-2	-0.24	-0.10	-0.01	0.01
-3	-0.37	-0.14	-0.02	0.04
-5	-0.77	-0.23	-0.03	0.11
-6	-1.14	-0.28	-0.04	0.08
-7	-1.49	-0.32	-0.04	0.00
-11	-1.60	-0.41	-0.06	0.13
-13	-1.27	-0.43	-0.06	0.07
-15	-1.08	-0.44	-0.06	0.01
			Total	0.60



NOTES:
- i.e. -R=7.15m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

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Packer Test:	**220909-B-ANG-8**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
8.73E-03	1.32E-02
1.37E-02	2.07E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

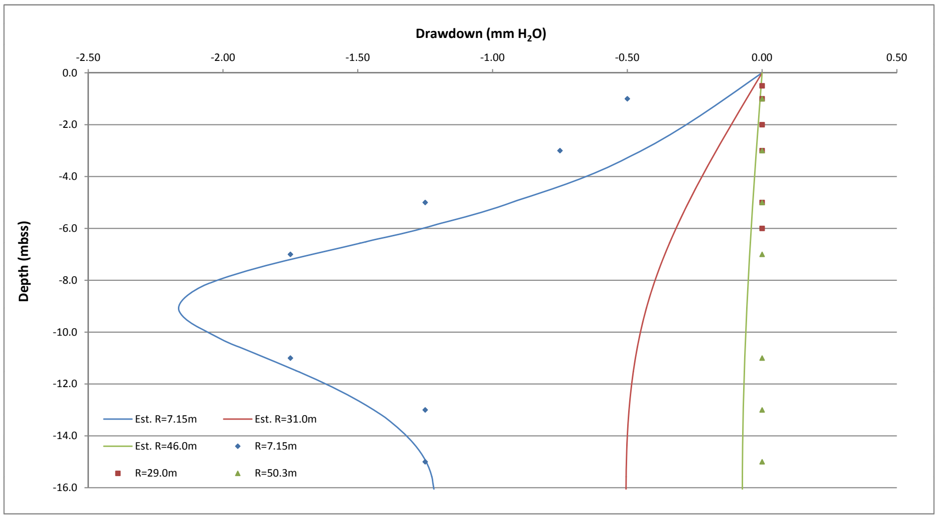
K_{gx} (m/s)	**KR** (-)	**KD** (-)
1.50E-04	0.25	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m ($mm\ H_2O$)	**CMT 147** R=31.0m ($mm\ H_2O$)	**CMT 143** R=46.0m ($mm\ H_2O$)
-0.5	-	0	-
-1	-0.50	0	0
-2	-	0	-
-3	-0.75	0	0
-5	-1.25	0	0
-6	-	0	-
-7	-1.75	-	0
-11	-1.75	-	0
-13	-1.25	-	0
-15	-1.25	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.09	-0.04	0.00	0.00
-1	-0.13	-0.06	-0.01	0.28
-2	-0.27	-0.11	-0.01	0.02
-3	-0.43	-0.16	-0.02	0.26
-5	-0.89	-0.27	-0.03	0.41
-6	-1.31	-0.33	-0.04	0.21
-7	-1.71	-0.36	-0.05	0.01
-11	-1.84	-0.47	-0.06	0.02
-13	-1.46	-0.49	-0.07	0.09
-15	-1.24	-0.50	-0.07	0.01
			Total	1.30



NOTES:
- i.e. -R=7.15m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**220909-B-ANG-8**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
8.73E-03	1.32E-02
1.37E-02	2.07E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

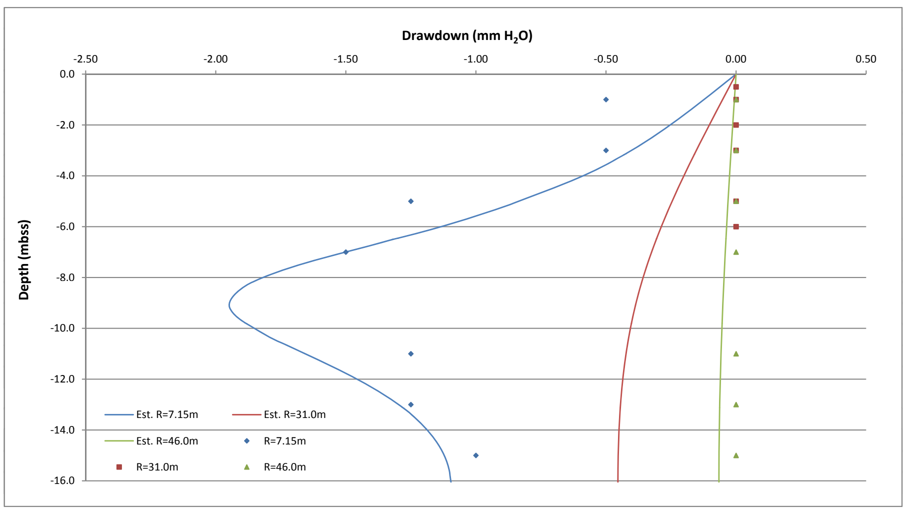
K_{gx} (m/s)	A_{gr} (-)	**KD** (-)
1.25E-04	0.25	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m ($mm\ H_2O$)	**CMT 147** R=31.0m ($mm\ H_2O$)	**CMT 143** R=46.0m ($mm\ H_2O$)
-0.5	-	0	-
-1	-0.50	0	0
-2	-	0	-
-3	-0.50	0	0
-5	-1.25	0	0
-6	-	0	-
-7	-1.50	-	0
-11	-1.25	-	0
-13	-1.25	-	0
-15	-1.00	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.08	-0.03	0.00	0.00
-1	-0.12	-0.05	-0.01	0.15
-2	-0.25	-0.10	-0.01	0.01
-3	-0.39	-0.15	-0.02	0.03
-5	-0.80	-0.24	-0.03	0.26
-6	-1.18	-0.29	-0.04	0.09
-7	-1.54	-0.33	-0.04	0.00
-11	-1.66	-0.42	-0.06	0.17
-13	-1.31	-0.44	-0.06	0.01
-15	-1.11	-0.45	-0.07	0.02
			Total	0.74



NOTES:
- i.e. -R=7.15m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test: **220909-B-ANG-8** **FLOW RATE 5**

Client: Syncrude Canada Ltd.

Test Date	22-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
8.73E-03	1.32E-02
1.37E-02	2.07E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.70E-05	1.23	999.68

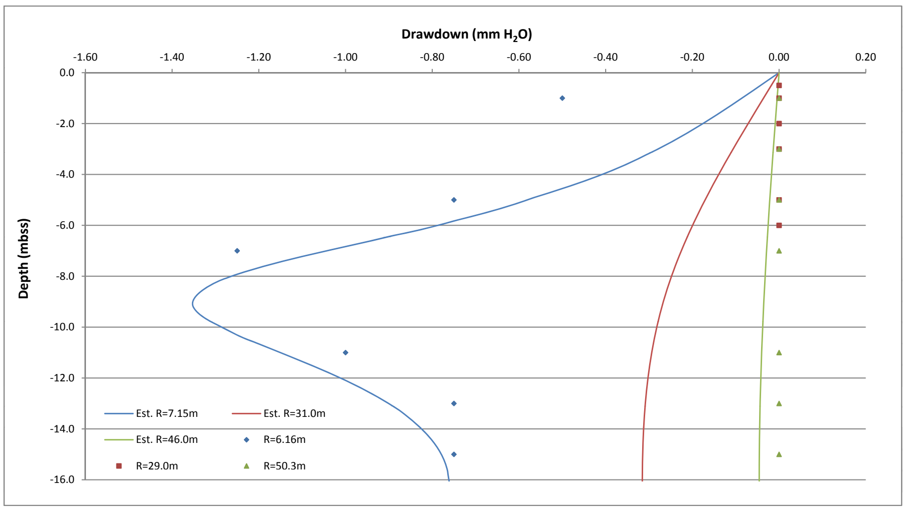
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.25E-04	0.25	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 144** R=7.15m ($mm\ H_2O$)	**CMT 147** R=31.0m ($mm\ H_2O$)	**CMT 143** R=46.0m ($mm\ H_2O$)
-0.5	-	0	-
-1	-0.50	0	0
-2	-	0	-
-3	0.00	0	0
-5	-0.75	0	0
-6	-	0	-
-7	-1.25	-	0
-11	-1.00	-	0
-13	-0.75	-	0
-15	-0.75	-	0

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.05	-0.02	0.00	0.00
-1	-0.08	-0.03	0.00	0.18
-2	-0.17	-0.07	-0.01	0.00
-3	-0.27	-0.10	-0.01	0.08
-5	-0.55	-0.17	-0.02	0.07
-6	-0.82	-0.20	-0.03	0.04
-7	-1.07	-0.23	-0.03	0.03
-11	-1.15	-0.29	-0.04	0.03
-13	-0.91	-0.31	-0.04	0.03
-15	-0.77	-0.31	-0.05	0.00
			Total	0.46



NOTES:

- i.e. -R=7.15m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

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Packer Test: **090909-C-VERT-1** **FLOW RATE 1**

Client: Syncrude Canada Ltd.

Test Date	9-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.32E-02	2.00E-02
1.56E-02	2.36E-02
1.84E-02	2.79E-02
1.46E-02	2.21E-02
1.32E-02	2.00E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.75E-05	1.21	999.68

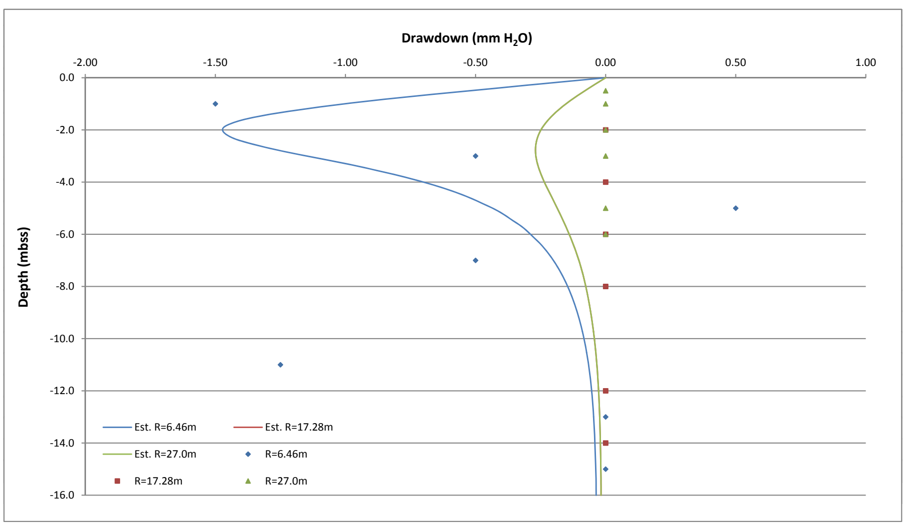
K_{gx} (m/s)	A_{gr} (-)	KD (-)
4.00E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm (mm H_2O)	**CMT 146** R=17.28m (mm H_2O)	**CMT 147** R=27.0m (mm H_2O)
-0.5	-	-	0
-1	-1.50	-	0
-2	-	0	0
-3	-0.50	-	0
-4	-	0	-
-5	0.50	-	0
-6	-	0	0
-7	-0.50	-	-
-8	-	0	-
-11	-1.25	-	-
-12	-	0	-
-13	0.00	-	-
-14	-	0	-
-15	0.00	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.67	-0.10	-0.10	0.01
-1	-0.97	-0.15	-0.15	0.30
-2	-1.47	-0.24	-0.24	0.12
-3	-1.21	-0.27	-0.27	0.57
-4	-0.65	-0.23	-0.23	0.05
-5	-0.41	-0.18	-0.18	0.86
-6	-0.28	-0.14	-0.14	0.04
-7	-0.20	-0.10	-0.10	0.09
-8	-0.15	-0.08	-0.08	0.01
-11	-0.07	-0.03	-0.03	1.40
-12	-0.05	-0.03	-0.03	0.00
-13	-0.05	-0.02	-0.02	0.00
-14	-0.04	-0.02	-0.02	0.00
-15	-0.04	-0.02	-0.02	0.00
-16	-0.04	-0.02	-0.02	0.00
			Total	3.46



NOTES:

- i.e. -R=6.46m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**090909-C-VERT-1**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	9-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.32E-02	2.00E-02
1.56E-02	2.36E-02
1.84E-02	2.79E-02
1.46E-02	2.21E-02
1.32E-02	2.00E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.75E-05	1.21	999.68

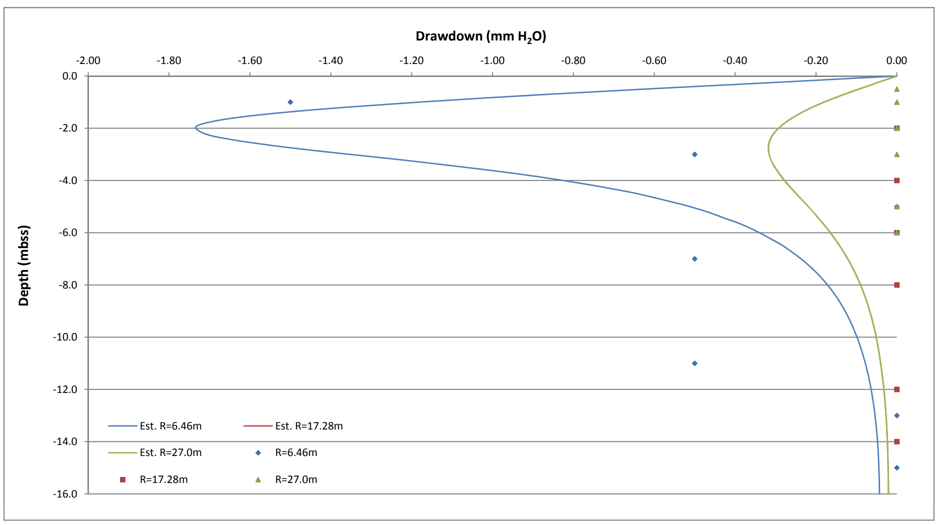
K_{gx} (m/s)	A_{gr} (-)	KD (-)
4.00E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	0
-1	-1.50	-	0
-2	-	0	0
-3	-0.50	-	0
-4	-	0	-
-5	0.00	-	0
-6	-	0	0
-7	-0.50	-	-
-8	-	0	-
-11	-0.50	-	-
-12	-	0	-
-13	0.00	-	-
-14	-	0	-
-15	0.00	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.79	-0.12	-0.12	0.01
-1	-1.14	-0.17	-0.17	0.16
-2	-1.73	-0.29	-0.29	0.17
-3	-1.42	-0.32	-0.32	0.96
-4	-0.76	-0.27	-0.27	0.07
-5	-0.48	-0.21	-0.21	0.28
-6	-0.33	-0.16	-0.16	0.05
-7	-0.23	-0.12	-0.12	0.07
-8	-0.17	-0.09	-0.09	0.01
-11	-0.08	-0.04	-0.04	0.18
-12	-0.06	-0.03	-0.03	0.00
-13	-0.05	-0.03	-0.03	0.00
-14	-0.05	-0.02	-0.02	0.00
-15	-0.04	-0.02	-0.02	0.00
-16	-0.04	-0.02	-0.02	0.00
			Total	1.96



NOTES:

- i.e. -R=6.46m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	090909-C-VERT-1	FLOW RATE 3
Client:	Syncrude Canada Ltd.	

Test Date	9-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	Flux (m/s)
1.32E-02	2.00E-02
1.56E-02	2.36E-02
1.84E-02	2.79E-02
1.46E-02	2.21E-02
1.32E-02	2.00E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.75E-05	1.21	999.68

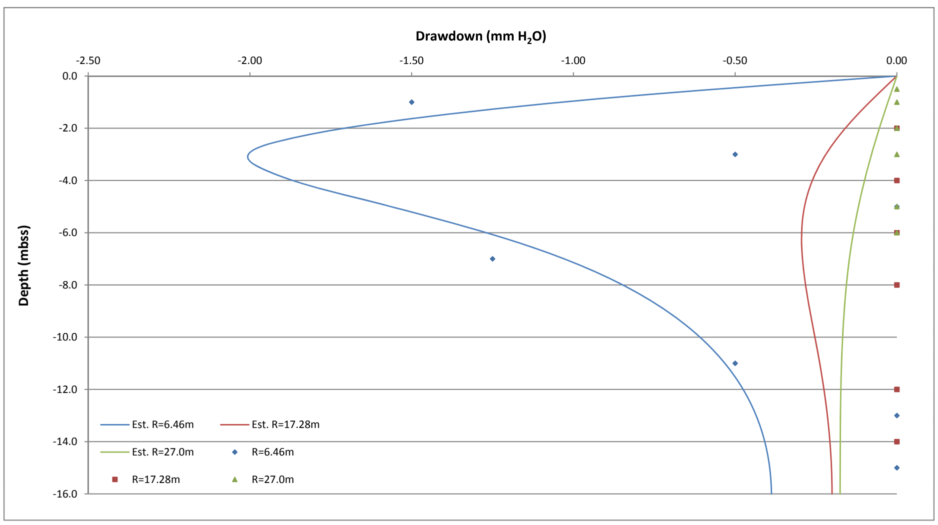
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.00E-04	0.25	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	CMT 145 R=6.46mm (mm H_2O)	CMT 146 R=17.28m (mm H_2O)	CMT 147 R=27.0m (mm H_2O)
-0.5	-	-	0
-1	-1.50	-	0
-2	-	0	0
-3	-0.50	-	0
-4	-	0	-
-5	0.00	-	0
-6	-	0	0
-7	-1.25	-	-
-8	-	0	-
-11	-0.50	-	-
-12	-	0	-
-13	0.00	-	-
-14	-	0	-
-15	0.00	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	CMT 144 R=7.15m TH (mm H_2O)	CMT 147 R=31.0m TH (mm H_2O)	CMT 143 R=46.0m TH (mm H_2O)	SLS (mm^2 H_2O)
-0.5	-0.70	-0.05	-0.02	0.00
-1	-1.00	-0.08	-0.03	0.25
-2	-1.67	-0.15	-0.05	0.03
-3	-2.00	-0.21	-0.08	2.24
-4	-1.82	-0.27	-0.10	0.07
-5	-1.53	-0.29	-0.12	2.35
-6	-1.25	-0.29	-0.14	0.10
-7	-1.02	-0.29	-0.15	0.05
-8	-0.85	-0.28	-0.16	0.04
-11	-0.54	-0.24	-0.17	0.00
-12	-0.47	-0.22	-0.17	0.05
-13	-0.43	-0.21	-0.17	0.19
-14	-0.41	-0.21	-0.18	0.04
-15	-0.39	-0.20	-0.18	0.15
-16	-0.39	-0.20	-0.18	0.04
			Total	5.57



NOTES:

- i.e. -R=6.46m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test: **090909-C-VERT-1** **FLOW RATE 4**

Client: Syncrude Canada Ltd.

Test Date	9-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.32E-02	2.00E-02
1.56E-02	2.36E-02
1.84E-02	2.79E-02
1.46E-02	2.21E-02
1.32E-02	2.00E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.75E-05	1.21	999.68

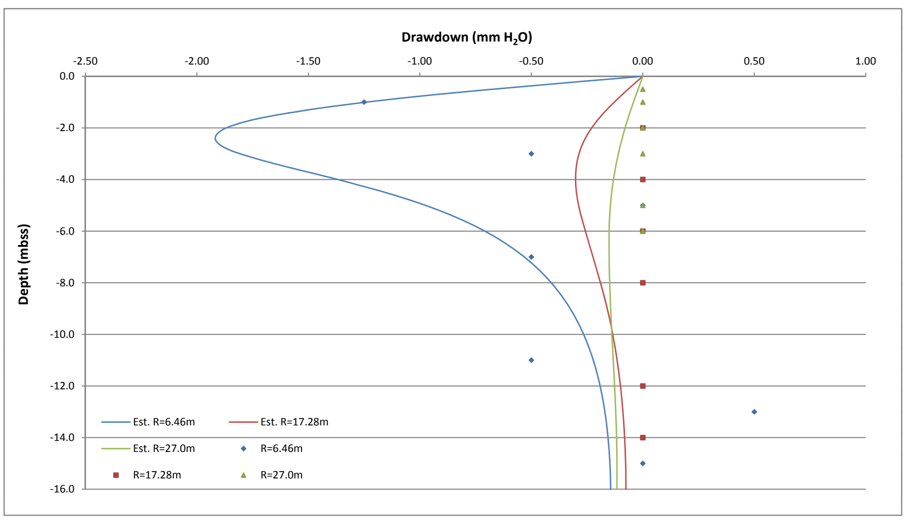
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.75E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	0
-1	-1.25	-	0
-2	-	0	0
-3	-0.50	-	0
-4	-	0	-
-5	0.00	-	0
-6	-	0	0
-7	-0.50	-	-
-8	-	0	-
-11	-0.50	-	-
-12	-	0	-
-13	0.50	-	-
-14	-	0	-
-15	0.00	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.85	-0.08	-0.03	0.00
-1	-1.20	-0.12	-0.04	0.00
-2	-1.85	-0.22	-0.08	0.06
-3	-1.85	-0.28	-0.11	1.82
-4	-1.30	-0.30	-0.13	0.09
-5	-0.94	-0.29	-0.15	0.90
-6	-0.69	-0.26	-0.15	0.09
-7	-0.52	-0.22	-0.15	0.00
-8	-0.41	-0.19	-0.15	0.04
-11	-0.23	-0.12	-0.13	0.07
-12	-0.19	-0.10	-0.13	0.01
-13	-0.17	-0.09	-0.12	0.45
-14	-0.15	-0.08	-0.12	0.01
-15	-0.15	-0.08	-0.12	0.02
-16	-0.14	-0.08	-0.12	0.03
			Total	3.56



NOTES:

- i.e. -R=6.46m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**090909-C-VERT-1**	**FLOW RATE 5**
Client:	Syncrude Canada Ltd.	

Test Date	9-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
1.32E-02	2.00E-02
1.56E-02	2.36E-02
1.84E-02	2.79E-02
1.46E-02	2.21E-02
1.32E-02	2.00E-02

μ_g (Pa s)	**ρ_g** (kg/m^3)	**μ_w** (kg/m^3)
1.75E-05	1.21	999.68

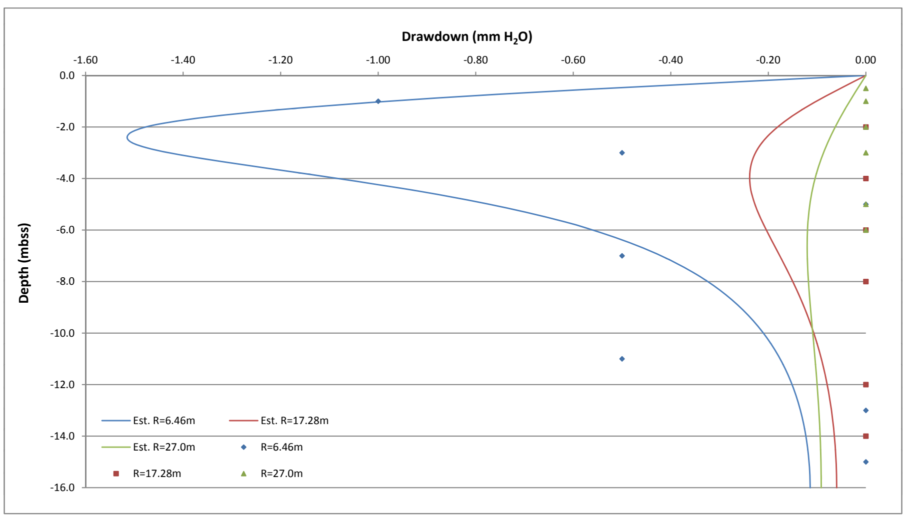
K_{gx} (m/s)	**A_{gr}** (-)	**KD** (-)
2.00E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm (mm H_2O)	**CMT 146** R=17.28m (mm H_2O)	**CMT 147** R=27.0m (mm H_2O)
-0.5	-	-	0
-1	-1.00	-	0
-2	-	0	0
-3	-0.50	-	0
-4	-	0	-
-5	0.00	-	0
-6	-	0	0
-7	-0.50	-	-
-8	-	0	-
-11	-0.50	-	-
-12	-	0	-
-13	0.00	-	-
-14	-	0	-
-15	0.00	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.67	-0.07	-0.02	0.00
-1	-0.95	-0.10	-0.03	0.00
-2	-1.46	-0.18	-0.06	0.03
-3	-1.46	-0.22	-0.08	0.93
-4	-1.03	-0.24	-0.11	0.06
-5	-0.74	-0.23	-0.12	0.56
-6	-0.55	-0.20	-0.12	0.06
-7	-0.41	-0.18	-0.12	0.01
-8	-0.32	-0.15	-0.12	0.02
-11	-0.18	-0.09	-0.10	0.10
-12	-0.15	-0.08	-0.10	0.01
-13	-0.13	-0.07	-0.10	0.02
-14	-0.12	-0.06	-0.09	0.00
-15	-0.12	-0.06	-0.09	0.01
-16	-0.11	-0.06	-0.09	0.02
			Total	1.81



NOTES:
- i.e. -R=6.46m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**090909-C-VERT-2**	**FLOW RATE 1**
Client:	Syncrude Canada Ltd.	

Test Date	9-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
1.37E-02	2.07E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.73E-05	1.22	999.68

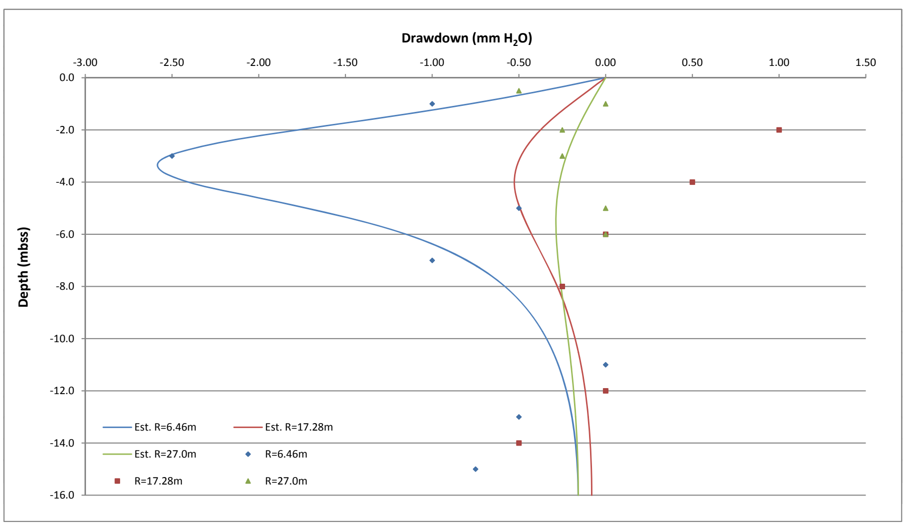
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.50E-04	0.06	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm (mm H_2O)	**CMT 146** R=17.28m (mm H_2O)	**CMT 147** R=27.0m (mm H_2O)
-0.5	-	-	-0.5
-1	-1.00	-	0
-2	-	1	-0.25
-3	-2.50	-	-0.25
-4	-	0	-
-5	-0.50	-	0
-6	-	0	0
-7	-1.00	-	-
-8	-	-0.25	-
-11	0.00	-	-
-12	-	0	-
-13	-0.50	-	-
-14	-	-0.5	-
-15	-0.75	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.48	-0.13	-0.06	0.20
-1	-0.74	-0.19	-0.08	0.07
-2	-1.69	-0.36	-0.16	1.87
-3	-2.47	-0.48	-0.22	0.00
-4	-2.31	-0.53	-0.27	1.05
-5	-1.64	-0.49	-0.28	1.38
-6	-1.11	-0.42	-0.28	0.26
-7	-0.79	-0.35	-0.27	0.04
-8	-0.58	-0.28	-0.26	0.08
-11	-0.28	-0.15	-0.20	0.08
-12	-0.22	-0.11	-0.18	0.01
-13	-0.19	-0.10	-0.17	0.09
-14	-0.17	-0.09	-0.16	0.17
-15	-0.16	-0.08	-0.16	0.35
-16	-0.16	-0.08	-0.16	0.01
			Total	5.65



NOTES:
- i.e. -R=6.46m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**090909-C-VERT-2**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	9-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
1.37E-02	2.07E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.73E-05	1.22	999.68

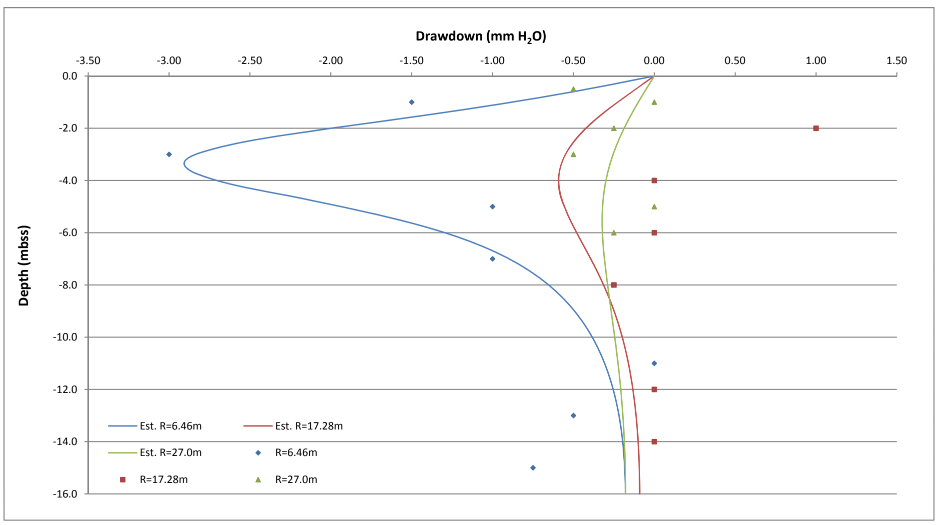
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.00E-04	0.06	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	-0.5
-1	-1.50	-	0
-2	-	1	-0.25
-3	-3.00	-	-0.5
-4	-	0	-
-5	-1.00	-	0
-6	-	0	-0.25
-7	-1.00	-	-
-8	-	-0.25	-
-11	0.00	-	-
-12	-	0	-
-13	-0.50	-	-
-14	-	0	-
-15	-0.75	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.54	-0.15	-0.06	0.19
-1	-0.84	-0.22	-0.09	0.45
-2	-1.91	-0.41	-0.18	1.99
-3	-2.78	-0.54	-0.25	0.11
-4	-2.60	-0.59	-0.30	0.35
-5	-1.85	-0.55	-0.32	0.82
-6	-1.25	-0.47	-0.32	0.23
-7	-0.89	-0.39	-0.31	0.01
-8	-0.65	-0.31	-0.29	0.10
-11	-0.32	-0.16	-0.23	0.10
-12	-0.25	-0.13	-0.21	0.02
-13	-0.22	-0.11	-0.19	0.08
-14	-0.19	-0.10	-0.18	0.01
-15	-0.18	-0.09	-0.18	0.32
-16	-0.18	-0.09	-0.18	0.01
			Total	4.77



NOTES:

- i.e. -R=6.46m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**090909-C-VERT-2**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	9-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
1.37E-02	2.07E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.73E-05	1.22	999.68

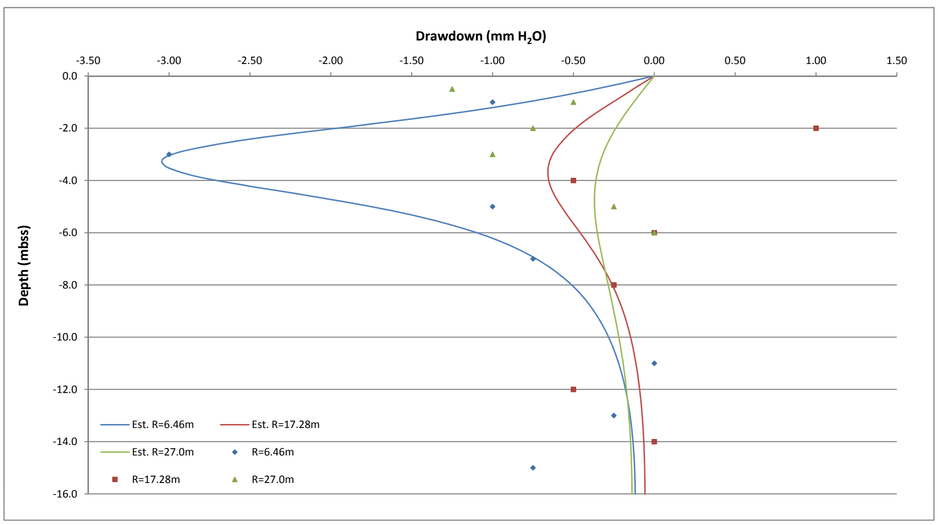
K_{gx} (m/s)	A_{gr} (-)	KD (-)
3.25E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm (mm H_2O)	**CMT 146** R=17.28m (mm H_2O)	**CMT 147** R=27.0m (mm H_2O)
-0.5	-	-	-1.25
-1	-1.00	-	-0.5
-2	-	1	-0.75
-3	-3.00	-	-1
-4	-	-0.5	-
-5	-1.00	-	-0.25
-6	-	0	0
-7	-0.75	-	-
-8	-	-0.25	-
-11	0.00	-	-
-12	-	-0.5	-
-13	-0.25	-	-
-14	-	0	-
-15	-0.75	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.48	-0.17	-0.08	1.36
-1	-0.75	-0.25	-0.12	0.20
-2	-1.86	-0.47	-0.23	2.43
-3	-2.92	-0.62	-0.31	0.48
-4	-2.56	-0.65	-0.37	0.02
-5	-1.66	-0.56	-0.37	0.45
-6	-1.06	-0.45	-0.35	0.32
-7	-0.72	-0.34	-0.32	0.00
-8	-0.51	-0.26	-0.28	0.07
-11	-0.23	-0.12	-0.20	0.05
-12	-0.17	-0.09	-0.17	0.17
-13	-0.15	-0.07	-0.16	0.01
-14	-0.13	-0.06	-0.15	0.00
-15	-0.12	-0.06	-0.14	0.40
-16	-0.12	-0.06	-0.14	0.00
			Total	5.97



NOTES:

- i.e. -R=6.46m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**090909-C-VERT-2**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	9-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
1.37E-02	2.07E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.73E-05	1.22	999.68

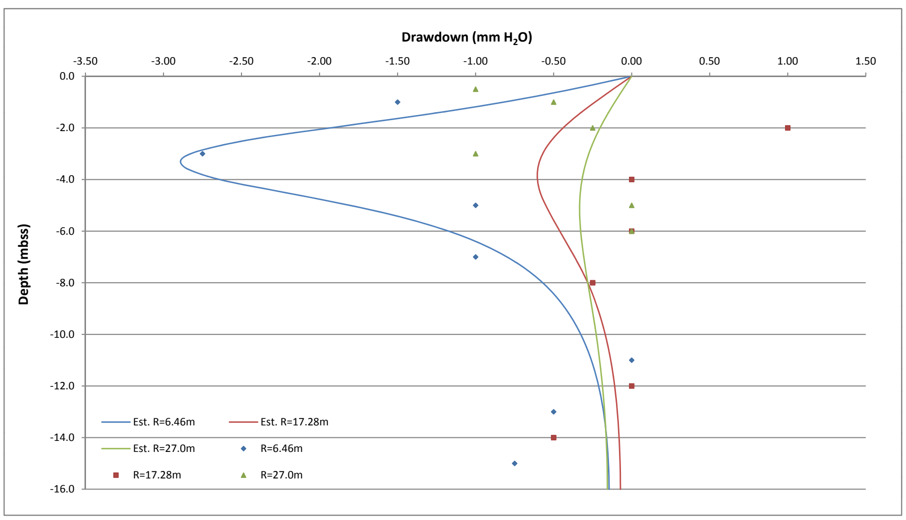
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.25E-04	0.05	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm (mm H_2O)	**CMT 146** R=17.28m (mm H_2O)	**CMT 147** R=27.0m (mm H_2O)
-0.5	-	-	-1
-1	-1.50	-	-0.5
-2	-	1	-0.25
-3	-2.75	-	-1
-4	-	-0.5	-
-5	-1.00	-	0
-6	-	0	0
-7	-1.00	-	-
-8	-	-0.25	-
-11	0.00	-	-
-12	-	0	-
-13	-0.50	-	-
-14	-	-0.5	-
-15	-0.75	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.50	-0.15	-0.07	0.87
-1	-0.78	-0.23	-0.10	0.68
-2	-1.84	-0.43	-0.20	2.03
-3	-2.77	-0.56	-0.27	0.54
-4	-2.52	-0.60	-0.32	0.36
-5	-1.72	-0.54	-0.33	0.63
-6	-1.13	-0.45	-0.33	0.31
-7	-0.79	-0.36	-0.31	0.04
-8	-0.57	-0.28	-0.28	0.08
-11	-0.27	-0.14	-0.21	0.07
-12	-0.21	-0.11	-0.18	0.01
-13	-0.18	-0.09	-0.17	0.10
-14	-0.16	-0.08	-0.16	0.18
-15	-0.15	-0.07	-0.16	0.36
-16	-0.14	-0.07	-0.16	0.01
			Total	6.26



NOTES:
- i.e. -R=6.46m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	090909-C-VERT-2	FLOW RATE 5
Client:	Syncrude Canada Ltd.	

Test Date	9-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
1.37E-02	2.07E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.73E-05	1.22	999.68

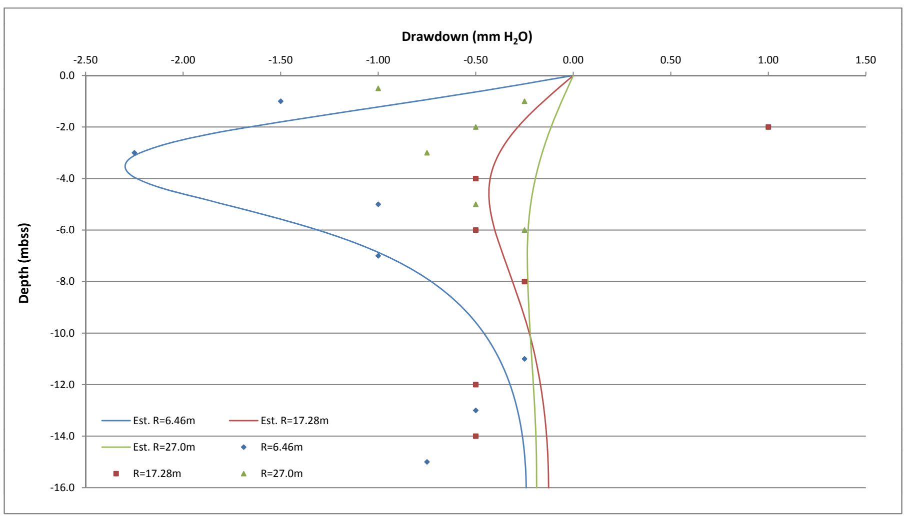
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.75E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	-1
-1	-1.50	-	-0.25
-2	-	1	-0.5
-3	-2.25	-	-0.75
-4	-	-0.25	-
-5	-1.00	-	-0.5
-6	-	-0.5	-0.25
-7	-1.00	-	-
-8	-	-0.25	-
-11	-0.25	-	-
-12	-	-0.5	-
-13	-0.50	-	-
-14	-	-0.5	-
-15	-0.75	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.50	-0.10	-0.04	0.93
-1	-0.77	-0.15	-0.06	0.57
-2	-1.60	-0.27	-0.11	1.78
-3	-2.18	-0.37	-0.15	0.36
-4	-2.19	-0.43	-0.20	0.00
-5	-1.73	-0.43	-0.22	0.61
-6	-1.27	-0.40	-0.23	0.01
-7	-0.95	-0.36	-0.24	0.00
-8	-0.73	-0.31	-0.23	0.10
-11	-0.39	-0.20	-0.21	0.02
-12	-0.32	-0.16	-0.20	0.11
-13	-0.28	-0.15	-0.20	0.05
-14	-0.26	-0.14	-0.19	0.13
-15	-0.25	-0.13	-0.19	0.25
-16	-0.24	-0.13	-0.19	0.02
			Total	4.92



NOTES:
- i.e. -R=6.46m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test: **180909-C-VERT-1** **FLOW RATE 1**

Client: Syncrude Canada Ltd.

Test Date	18-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.73E-05	1.22	999.68

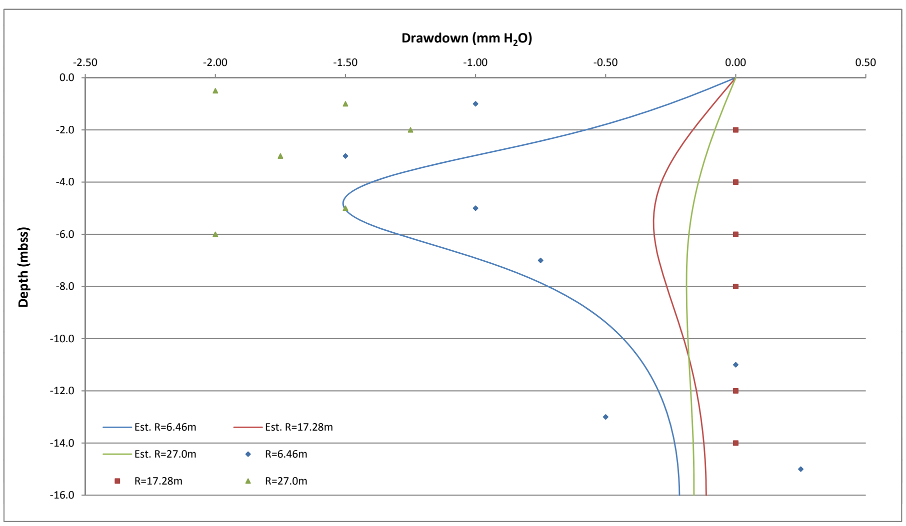
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.00E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	-2
-1	-1.00	-	-1.5
-2	-	0	-1.25
-3	-1.50	-	-1.75
-4	-	-1.5	-
-5	-1.00	-	-1.5
-6	-	0	-2
-7	-0.75	-	-
-8	-	0	-
-11	0.00	-	-
-12	-	0	-
-13	-0.50	-	-
-14	-	0	-
-15	0.25	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.16	-0.05	-0.03	3.89
-1	-0.24	-0.08	-0.04	2.70
-2	-0.55	-0.16	-0.08	1.40
-3	-0.96	-0.23	-0.11	2.98
-4	-1.44	-0.29	-0.15	0.09
-5	-1.49	-0.31	-0.17	2.02
-6	-1.27	-0.31	-0.18	3.41
-7	-0.96	-0.29	-0.19	0.05
-8	-0.72	-0.27	-0.19	0.07
-11	-0.36	-0.18	-0.18	0.13
-12	-0.29	-0.15	-0.17	0.02
-13	-0.26	-0.13	-0.17	0.06
-14	-0.23	-0.12	-0.16	0.01
-15	-0.22	-0.12	-0.16	0.22
-16	-0.22	-0.11	-0.16	0.01
			Total	17.06



NOTES:
- i.e. -R=6.46m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**180909-C-VERT-1**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	18-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.73E-05	1.22	999.68

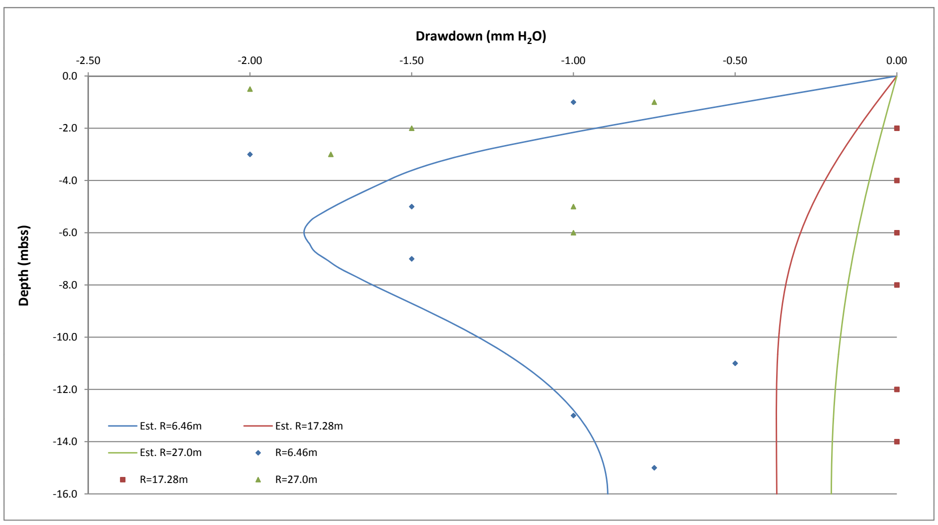
K_{gx} (m/s)	A_{gr} (-)	KD (-)
8.00E-05	0.5	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	-2
-1	-1.00	-	-0.75
-2	-	0	-1.5
-3	-2.00	-	-1.75
-4	-	-0.75	-
-5	-1.50	-	-1
-6	-	0	-1
-7	-1.50	-	-
-8	-	0	-
-11	-0.50	-	-
-12	-	0	-
-13	-1.00	-	-
-14	-	0	-
-15	-0.75	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.30	-0.04	-0.01	3.94
-1	-0.45	-0.06	-0.02	0.83
-2	-0.90	-0.11	-0.04	2.14
-3	-1.29	-0.17	-0.06	3.35
-4	-1.60	-0.23	-0.09	0.05
-5	-1.76	-0.27	-0.11	0.87
-6	-1.83	-0.30	-0.12	0.86
-7	-1.76	-0.33	-0.14	0.07
-8	-1.62	-0.34	-0.15	0.12
-11	-1.18	-0.37	-0.18	0.46
-12	-1.05	-0.37	-0.19	0.14
-13	-0.98	-0.37	-0.20	0.00
-14	-0.93	-0.37	-0.20	0.14
-15	-0.90	-0.37	-0.20	0.02
-16	-0.89	-0.37	-0.20	0.14
			Total	12.99



NOTES:

- i.e. -R=6.46m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

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Packer Test:	**180909-C-VERT-1**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	18-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.73E-05	1.22	999.68

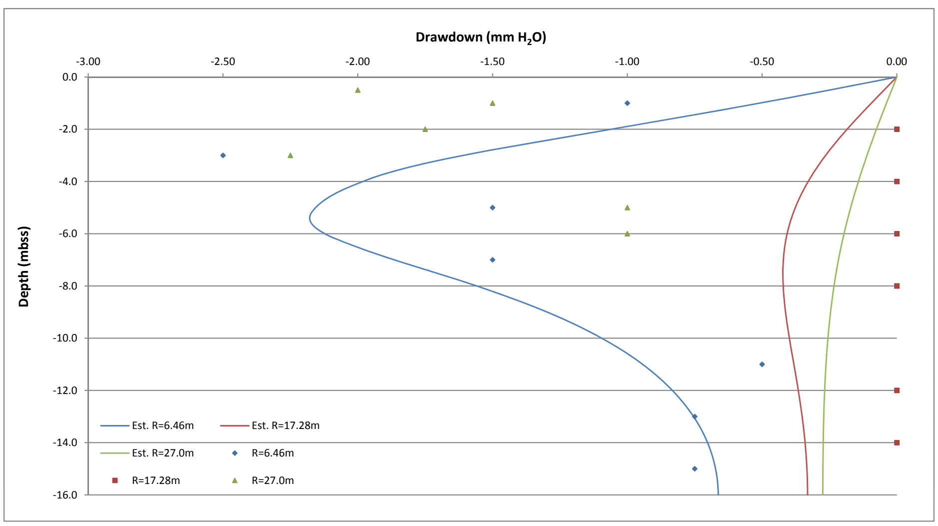
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.50E-04	0.25	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm (mm H_2O)	**CMT 146** R=17.28m (mm H_2O)	**CMT 147** R=27.0m (mm H_2O)
-0.5	-	-	-2
-1	-1.00	-	-1.5
-2	-	0	-1.75
-3	-2.50	-	-2.25
-4	-	-1.5	-
-5	-1.50	-	-1
-6	-	0	-1
-7	-1.50	-	-
-8	-	0	-
-11	-0.50	-	-
-12	-	0	-
-13	-0.75	-	-
-14	-	0	-
-15	-0.75	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.32	-0.06	-0.02	3.90
-1	-0.49	-0.09	-0.04	2.40
-2	-1.01	-0.18	-0.07	2.84
-3	-1.55	-0.26	-0.11	5.50
-4	-2.02	-0.34	-0.15	0.11
-5	-2.17	-0.38	-0.17	1.12
-6	-2.11	-0.41	-0.20	0.81
-7	-1.85	-0.42	-0.22	0.12
-8	-1.56	-0.42	-0.23	0.18
-11	-0.96	-0.38	-0.26	0.21
-12	-0.82	-0.36	-0.27	0.13
-13	-0.75	-0.35	-0.27	0.00
-14	-0.70	-0.34	-0.27	0.12
-15	-0.67	-0.33	-0.27	0.01
-16	-0.66	-0.33	-0.27	0.11
			Total	17.46



NOTES:
- i.e. -R=6.46m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**180909-C-VERT-1**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	18-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.73E-05	1.22	999.68

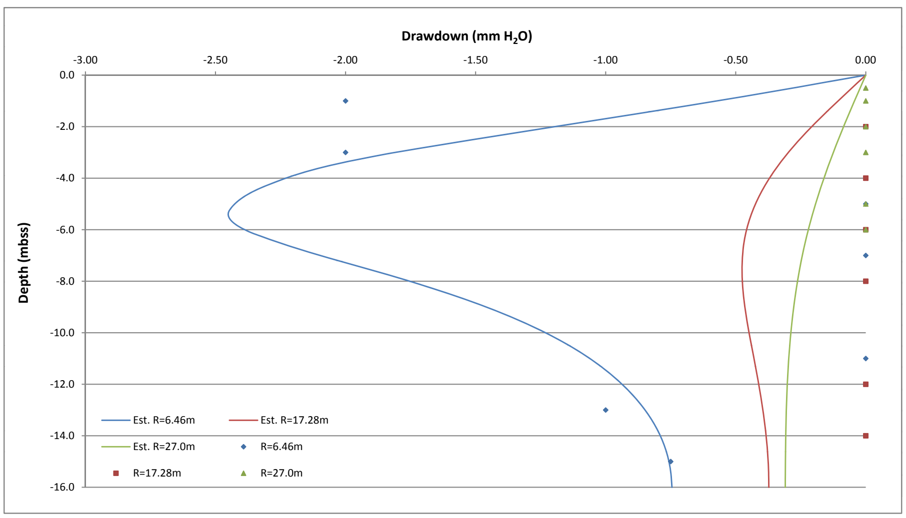
K_{gx} (m/s)	A_{gr} (-)	**KD** (-)
1.00E-04	0.25	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	0
-1	-2.00	-	0
-2	-	0	0
-3	-2.00	-	0
-4	-	0	-
-5	0.00	-	0
-6	-	0	0
-7	0.00	-	-
-8	-	0	-
-11	0.00	-	-
-12	-	0	-
-13	-1.00	-	-
-14	-	0	-
-15	-0.75	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.36	-0.07	-0.03	0.00
-1	-0.55	-0.10	-0.04	2.10
-2	-1.14	-0.20	-0.08	0.05
-3	-1.74	-0.29	-0.12	0.08
-4	-2.27	-0.38	-0.17	0.14
-5	-2.44	-0.43	-0.20	5.98
-6	-2.37	-0.46	-0.22	0.26
-7	-2.08	-0.47	-0.24	4.33
-8	-1.75	-0.47	-0.26	0.23
-11	-1.08	-0.43	-0.30	1.16
-12	-0.92	-0.41	-0.30	0.17
-13	-0.84	-0.39	-0.31	0.03
-14	-0.79	-0.38	-0.31	0.15
-15	-0.76	-0.38	-0.31	0.00
-16	-0.75	-0.37	-0.31	0.14
			Total	14.68



NOTES:

- i.e. -R=6.46m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**180909-C-VERT-1**	**FLOW RATE 5**
Client:	Syncrude Canada Ltd.	

Test Date	18-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.73E-05	1.22	999.68

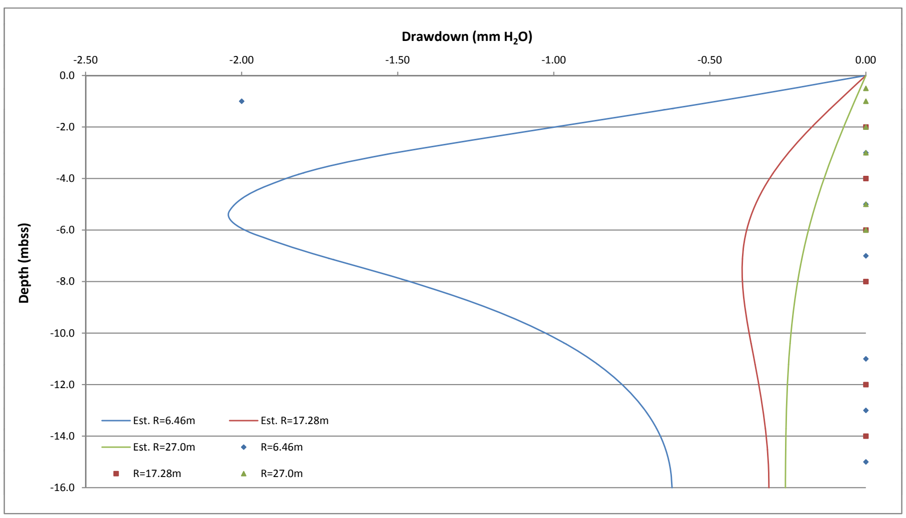
K_{gx} (m/s)	A_{gr} (-)	KD (-)
8.00E-05	0.25	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm H_2O$)	**CMT 146** R=17.28m ($mm H_2O$)	**CMT 147** R=27.0m ($mm H_2O$)
-0.5	-	-	0
-1	-2.00	-	0
-2	-	0	0
-3	0.00	-	0
-4	-	0	-
-5	0.00	-	0
-6	-	0	0
-7	0.00	-	-
-8	-	0	-
-11	0.00	-	-
-12	-	0	-
-13	0.00	-	-
-14	-	0	-
-15	0.00	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm H_2O$)	**CMT 147** R=31.0m TH ($mm H_2O$)	**CMT 143** R=46.0m TH ($mm H_2O$)	**SLS** ($mm^2 H_2O$)
-0.5	-0.30	-0.06	-0.02	0.00
-1	-0.46	-0.09	-0.03	2.38
-2	-0.95	-0.17	-0.07	0.03
-3	-1.45	-0.24	-0.10	2.12
-4	-1.89	-0.32	-0.14	0.10
-5	-2.03	-0.36	-0.16	4.15
-6	-1.98	-0.38	-0.19	0.18
-7	-1.73	-0.39	-0.20	3.01
-8	-1.46	-0.40	-0.22	0.16
-11	-0.90	-0.36	-0.25	0.81
-12	-0.77	-0.34	-0.25	0.12
-13	-0.70	-0.33	-0.25	0.49
-14	-0.66	-0.32	-0.26	0.10
-15	-0.63	-0.31	-0.26	0.40
-16	-0.62	-0.31	-0.26	0.10
			Total	14.04



NOTES:

- i.e. -R=6.46m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test: **180909-C-VERT-2** **FLOW RATE 1**

Client: Syncrude Canada Ltd.

Test Date	18-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.74E-05	1.21	999.68

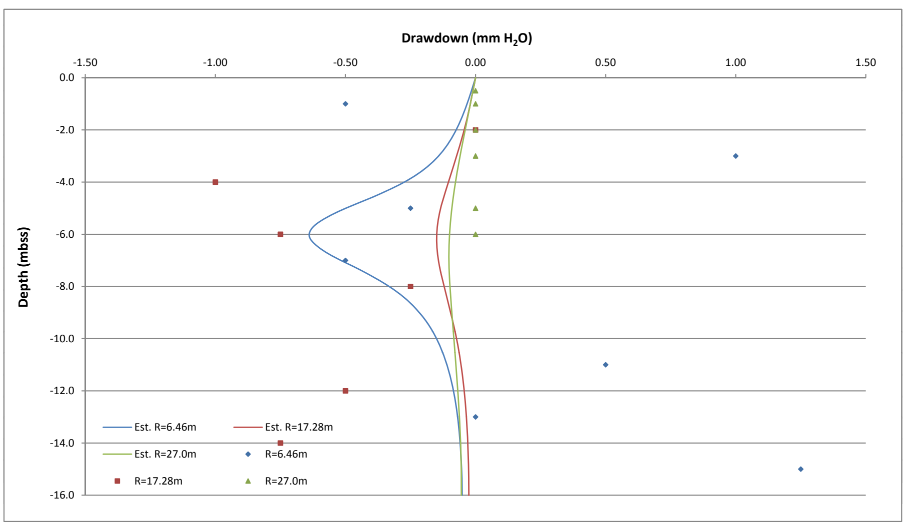
K_{gx} (m/s)	A_{gr} (-)	KD (-)
8.25E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	0
-1	-0.50	-	0
-2	-	0	0
-3	1.00	-	0
-4	-	0	-
-5	-0.25	-	0
-6	-	-0.75	0
-7	-0.50	-	-
-8	-	-0.25	-
-11	0.50	-	-
-12	-	-0.5	-
-13	0.00	-	-
-14	-	-0.75	-
-15	1.25	-	-
-16	-	-0.5	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.02	-0.01	-0.01	0.00
-1	-0.03	-0.02	-0.02	0.22
-2	-0.07	-0.04	-0.04	0.00
-3	-0.13	-0.07	-0.06	1.28
-4	-0.31	-0.11	-0.08	0.79
-5	-0.53	-0.14	-0.09	0.08
-6	-0.64	-0.15	-0.10	0.37
-7	-0.51	-0.14	-0.10	0.00
-8	-0.33	-0.12	-0.10	0.02
-11	-0.11	-0.06	-0.08	0.38
-12	-0.08	-0.04	-0.07	0.21
-13	-0.07	-0.03	-0.06	0.00
-14	-0.06	-0.03	-0.06	0.52
-15	-0.05	-0.03	-0.06	1.70
-16	-0.05	-0.03	-0.05	0.22
			Total	5.58



NOTES:

- i.e. -R=6.46m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**180909-C-VERT-2**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	18-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.74E-05	1.21	999.68

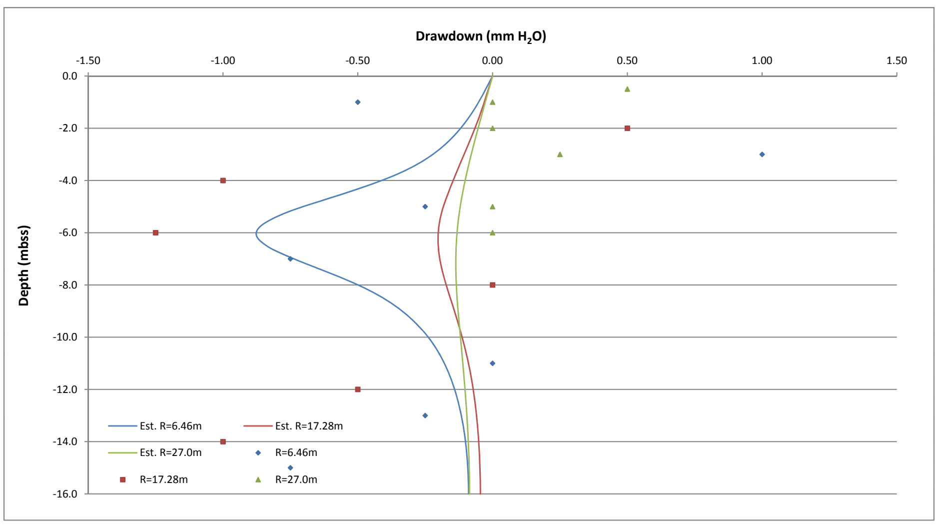
K_{gx} (m/s)	A_{gr} (-)	**KD** (-)
8.00E-04	0.05	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	0.5
-1	-0.50	-	0
-2	-	0.5	0
-3	1.00	-	0.25
-4	-	0	-
-5	-0.25	-	0
-6	-	-1.25	0
-7	-0.75	-	-
-8	-	0	-
-11	0.00	-	-
-12	-	-0.5	-
-13	-0.25	-	-
-14	-	-1	-
-15	-0.75	-	-
-16	-	-0.5	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.03	-0.02	-0.02	0.27
-1	-0.05	-0.03	-0.03	0.20
-2	-0.11	-0.06	-0.05	0.32
-3	-0.20	-0.10	-0.08	1.56
-4	-0.45	-0.15	-0.10	0.72
-5	-0.74	-0.19	-0.12	0.25
-6	-0.88	-0.20	-0.13	1.12
-7	-0.73	-0.20	-0.14	0.00
-8	-0.50	-0.17	-0.13	0.03
-11	-0.19	-0.09	-0.11	0.03
-12	-0.14	-0.07	-0.10	0.19
-13	-0.11	-0.06	-0.09	0.02
-14	-0.10	-0.05	-0.09	0.90
-15	-0.09	-0.05	-0.09	0.43
-16	-0.09	-0.05	-0.09	0.21
			Total	6.04



NOTES:

- i.e. -R=6.46m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**180909-C-VERT-2**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	18-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.74E-05	1.21	999.68

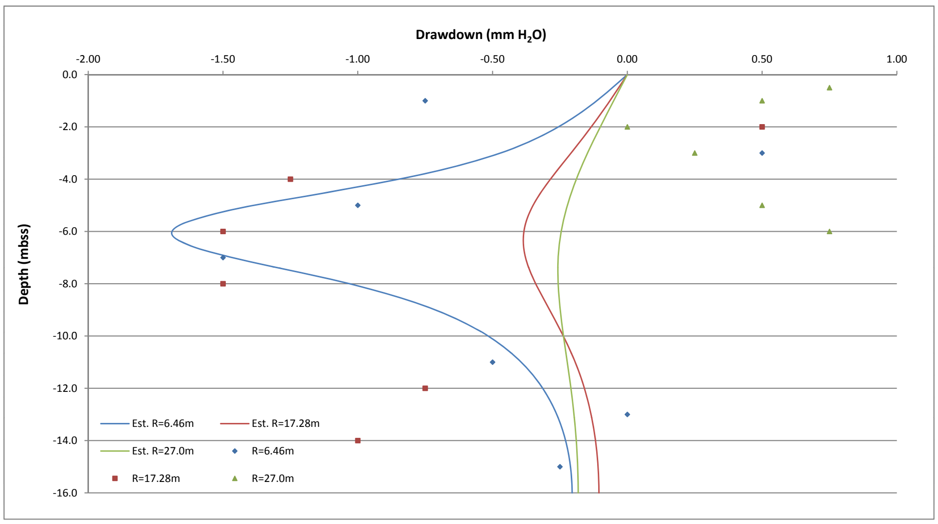
K_{gx} (m/s)	A_{gr} (-)	KD (-)
5.00E-04	0.06	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	0.75
-1	-0.75	-	0.5
-2	-	0.5	0
-3	0.50	-	0.25
-4	-	0.5	-
-5	-1.00	-	0.5
-6	-	-1.5	0.75
-7	-1.50	-	-
-8	-	-1.5	-
-11	-0.50	-	-
-12	-	-0.75	-
-13	0.00	-	-
-14	-	-1	-
-15	-0.25	-	-
-16	-	-0.75	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.07	-0.04	-0.03	0.61
-1	-0.11	-0.06	-0.05	0.71
-2	-0.24	-0.13	-0.10	0.40
-3	-0.44	-0.20	-0.14	1.03
-4	-0.93	-0.30	-0.19	0.91
-5	-1.44	-0.36	-0.23	0.72
-6	-1.69	-0.38	-0.25	2.24
-7	-1.45	-0.38	-0.26	0.00
-8	-1.03	-0.34	-0.26	1.35
-11	-0.41	-0.20	-0.22	0.01
-12	-0.30	-0.16	-0.21	0.35
-13	-0.26	-0.13	-0.20	0.07
-14	-0.23	-0.12	-0.19	0.78
-15	-0.21	-0.11	-0.18	0.00
-16	-0.20	-0.11	-0.18	0.42
			Total	9.19



NOTES:
- i.e. -R=6.46m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**180909-C-VERT-2**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	18-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.74E-05	1.21	999.68

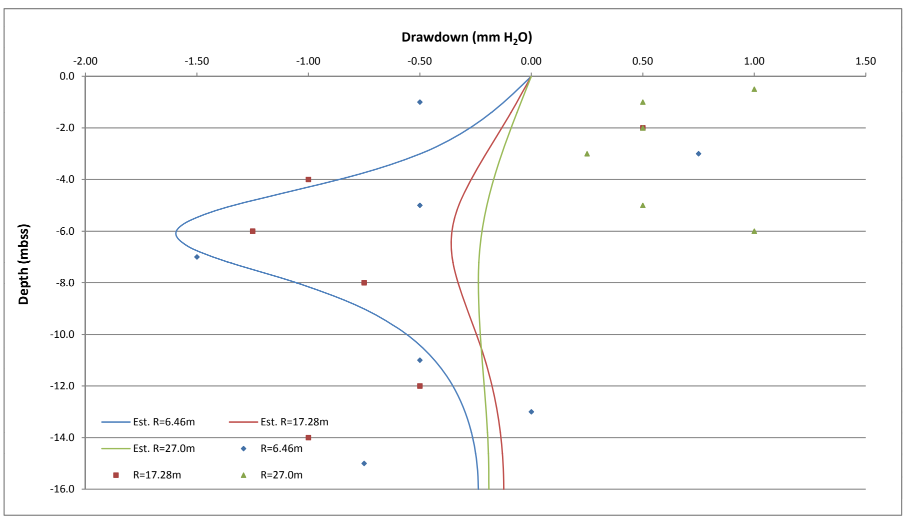
K_{gx} (m/s)	A_{gr} (-)	KD (-)
3.50E-04	0.075	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm H_2O$)	**CMT 146** R=17.28m ($mm H_2O$)	**CMT 147** R=27.0m ($mm H_2O$)
-0.5	-	-	1
-1	-0.50	-	0.5
-2	-	0.5	0.5
-3	0.75	-	0.25
-4	-	0.5	-
-5	-0.50	-	0.5
-6	-	-1.25	1
-7	-1.50	-	-
-8	-	-0.75	-
-11	-0.50	-	-
-12	-	-0.5	-
-13	0.00	-	-
-14	-	-1	-
-15	-0.75	-	-
-16	-	-0.75	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm H_2O$)	**CMT 147** R=31.0m TH ($mm H_2O$)	**CMT 143** R=46.0m TH ($mm H_2O$)	**SLS** ($mm^2 H_2O$)
-0.5	-0.08	-0.04	-0.03	1.06
-1	-0.12	-0.06	-0.04	0.44
-2	-0.26	-0.13	-0.09	0.74
-3	-0.46	-0.19	-0.13	1.62
-4	-0.94	-0.28	-0.17	0.52
-5	-1.38	-0.33	-0.20	1.27
-6	-1.59	-0.36	-0.22	2.29
-7	-1.42	-0.35	-0.23	0.01
-8	-1.05	-0.33	-0.24	0.18
-11	-0.45	-0.21	-0.22	0.00
-12	-0.34	-0.17	-0.21	0.11
-13	-0.29	-0.15	-0.20	0.09
-14	-0.26	-0.14	-0.20	0.75
-15	-0.24	-0.13	-0.19	0.26
-16	-0.24	-0.12	-0.19	0.39
			Total	9.32



NOTES:

- i.e. -R=6.46m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**180909-C-VERT-2**	**FLOW RATE 5**
Client:	Syncrude Canada Ltd.	

Test Date	18-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.74E-05	1.21	999.68

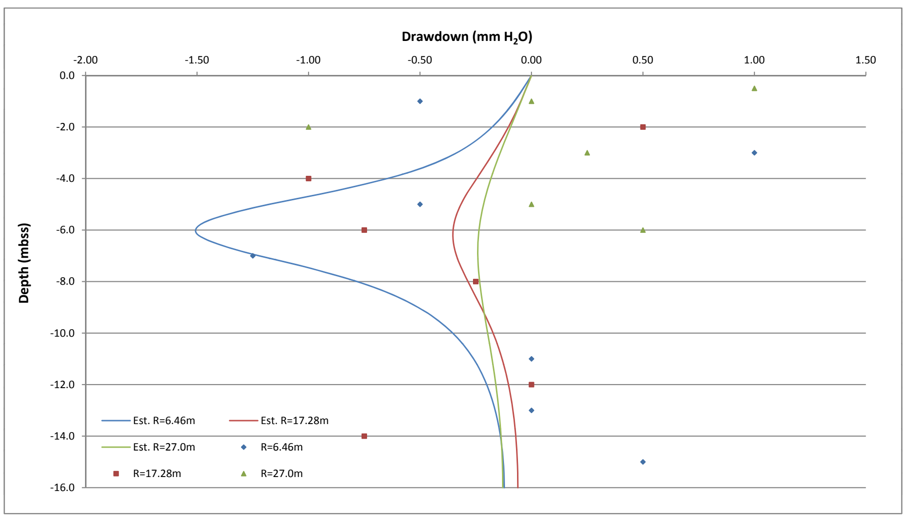
K_{gx} (m/s)	A_{gr} (-)	KD (-)
3.50E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm H_2O$)	**CMT 146** R=17.28m ($mm H_2O$)	**CMT 147** R=27.0m ($mm H_2O$)
-0.5	-	-	1
-1	-0.50	-	0
-2	-	0.5	-1
-3	1.00	-	0.25
-4	-	0	-
-5	-0.50	-	0
-6	-	-0.75	0.5
-7	-1.25	-	-
-8	-	-0.25	-
-11	0.00	-	-
-12	-	0	-
-13	0.00	-	-
-14	-	-0.75	-
-15	0.50	-	-
-16	-	-0.25	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm H_2O$)	**CMT 147** R=31.0m TH ($mm H_2O$)	**CMT 143** R=46.0m TH ($mm H_2O$)	**SLS** ($mm^2 H_2O$)
-0.5	-0.05	-0.03	-0.03	1.06
-1	-0.07	-0.05	-0.05	0.18
-2	-0.17	-0.10	-0.09	1.19
-3	-0.31	-0.16	-0.13	1.86
-4	-0.72	-0.26	-0.19	0.55
-5	-1.24	-0.32	-0.22	0.59
-6	-1.51	-0.35	-0.24	0.70
-7	-1.20	-0.33	-0.24	0.00
-8	-0.78	-0.29	-0.23	0.00
-11	-0.27	-0.14	-0.18	0.07
-12	-0.19	-0.10	-0.16	0.01
-13	-0.16	-0.08	-0.14	0.03
-14	-0.14	-0.07	-0.14	0.46
-15	-0.13	-0.06	-0.13	0.39
-16	-0.12	-0.06	-0.13	0.04
			Total	7.10



NOTES:
- i.e. -R=6.46m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**180909-C-VERT-3**	**FLOW RATE 1**
Client:	Syncrude Canada Ltd.	

Test Date	18-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.74E-05	1.21	999.68

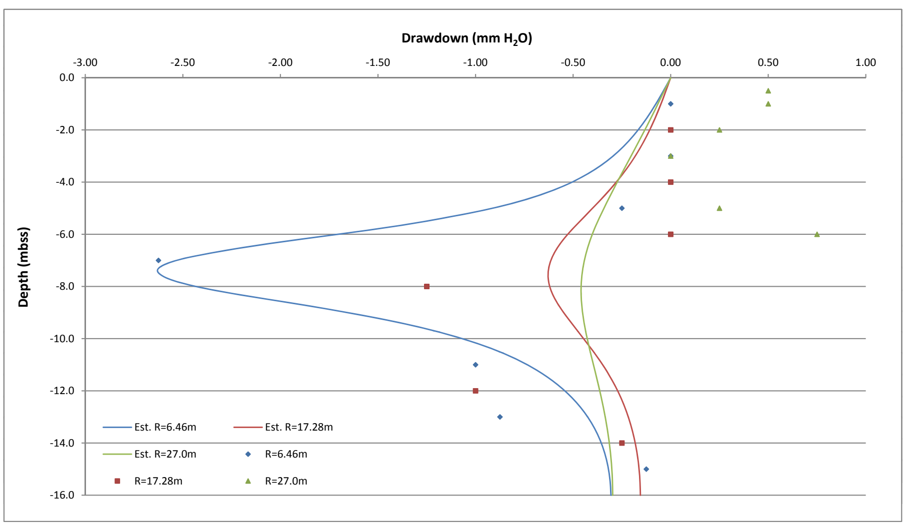
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.00E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm (mm H_2O)	**CMT 146** R=17.28m (mm H_2O)	**CMT 147** R=27.0m (mm H_2O)
-0.5	-	-	0.5
-1	0.00	-	0.5
-2	-	0	0.25
-3	0.00	-	0
-4	-	0.5	-
-5	-0.25	-	0.25
-6	-	0	0.75
-7	-2.63	-	-
-8	-	-1.25	-
-11	-1.00	-	-
-12	-	-1	-
-13	-0.88	-	-
-14	-	-0.25	-
-15	-0.13	-	-
-16	-	-1	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.05	-0.03	-0.04	0.29
-1	-0.07	-0.05	-0.06	0.32
-2	-0.16	-0.10	-0.13	0.15
-3	-0.28	-0.17	-0.19	0.11
-4	-0.55	-0.30	-0.29	0.09
-5	-0.99	-0.42	-0.35	0.90
-6	-1.78	-0.54	-0.41	1.62
-7	-2.55	-0.62	-0.44	0.01
-8	-2.43	-0.62	-0.46	0.40
-11	-0.77	-0.36	-0.40	0.05
-12	-0.52	-0.26	-0.36	0.54
-13	-0.42	-0.21	-0.33	0.21
-14	-0.35	-0.18	-0.31	0.00
-15	-0.32	-0.16	-0.30	0.04
-16	-0.31	-0.16	-0.30	0.71
			Total	4.75



NOTES:

- i.e. -R=6.46m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test: **180909-C-VERT-3** **FLOW RATE 2**

Client: Syncrude Canada Ltd.

Test Date	18-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.74E-05	1.21	999.68

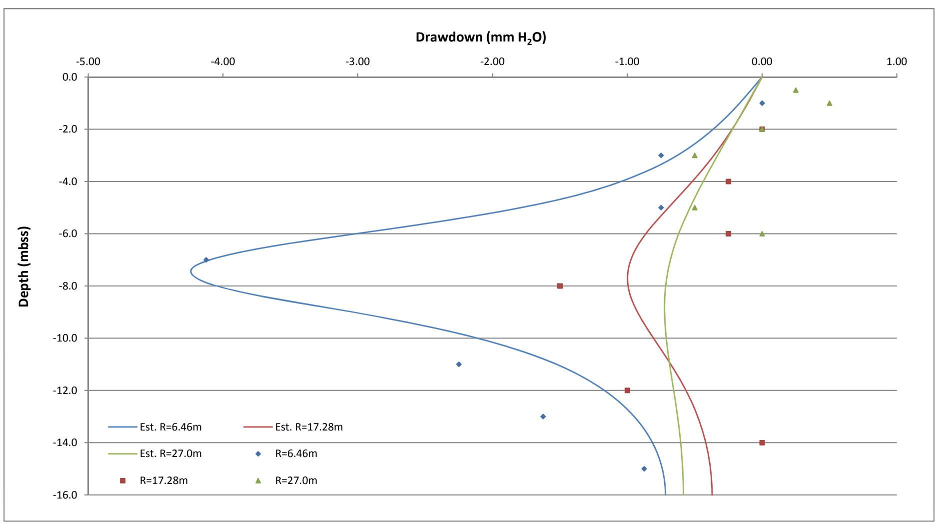
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.50E-04	0.06	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	0.25
-1	0.00	-	0.5
-2	-	0	0
-3	-0.75	-	-0.5
-4	-	0.5	-
-5	-0.75	-	-0.5
-6	-	-0.25	0
-7	-4.13	-	-
-8	-	-1.5	-
-11	-2.25	-	-
-12	-	-1	-
-13	-1.63	-	-
-14	-	0	-
-15	-0.88	-	-
-16	-	-1	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.11	-0.07	-0.07	0.10
-1	-0.16	-0.10	-0.11	0.39
-2	-0.35	-0.21	-0.21	0.09
-3	-0.59	-0.34	-0.32	0.06
-4	-1.13	-0.55	-0.45	0.09
-5	-1.91	-0.72	-0.55	1.35
-6	-3.12	-0.87	-0.62	0.78
-7	-4.12	-0.98	-0.68	0.00
-8	-4.05	-0.99	-0.72	0.26
-11	-1.59	-0.69	-0.69	0.44
-12	-1.13	-0.55	-0.65	0.20
-13	-0.93	-0.47	-0.62	0.49
-14	-0.81	-0.41	-0.60	0.17
-15	-0.74	-0.38	-0.59	0.02
-16	-0.72	-0.37	-0.58	0.40
			Total	4.43



NOTES:

- i.e. -R=6.46m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	180909-C-VERT-3	FLOW RATE 3
Client:	Syncrude Canada Ltd.	

Test Date	18-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	Flux (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.74E-05	1.21	999.68

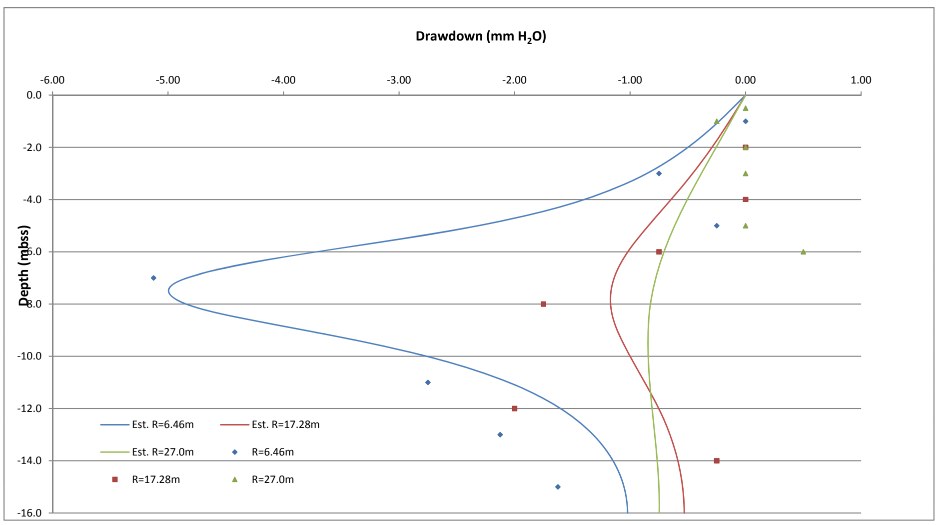
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.50E-04	0.075	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	CMT 145 R=6.46mm ($mm\ H_2O$)	CMT 146 R=17.28m ($mm\ H_2O$)	CMT 147 R=27.0m ($mm\ H_2O$)
-0.5	-	-	0
-1	0.00	-	-0.25
-2	-	0	0
-3	-0.75	-	0
-4	-	-0.25	-
-5	-0.25	-	0
-6	-	-0.75	0.5
-7	-5.13	-	-
-8	-	-1.75	-
-11	-2.75	-	-
-12	-	-2	-
-13	-2.13	-	-
-14	-	-0.25	-
-15	-1.63	-	-
-16	-	-1	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	CMT 144 R=7.15m TH ($mm\ H_2O$)	CMT 147 R=31.0m TH ($mm\ H_2O$)	CMT 143 R=46.0m TH ($mm\ H_2O$)	SLS ($mm^2\ H_2O$)
-0.5	-0.15	-0.09	-0.08	0.01
-1	-0.22	-0.13	-0.12	0.06
-2	-0.48	-0.28	-0.25	0.14
-3	-0.81	-0.44	-0.37	0.14
-4	-1.51	-0.68	-0.52	0.46
-5	-2.46	-0.86	-0.63	5.29
-6	-3.82	-1.03	-0.71	1.55
-7	-4.86	-1.14	-0.78	0.07
-8	-4.84	-1.17	-0.82	0.34
-11	-2.12	-0.89	-0.83	0.39
-12	-1.55	-0.74	-0.80	1.60
-13	-1.29	-0.65	-0.78	0.69
-14	-1.14	-0.58	-0.76	0.11
-15	-1.05	-0.54	-0.75	0.33
-16	-1.02	-0.53	-0.75	0.22
			Total	11.18



NOTES:

- i.e. -R=6.46m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**180909-C-VERT-3**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	18-Sep-09
Test Interval Temperature (^{o}C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.74E-05	1.21	999.68

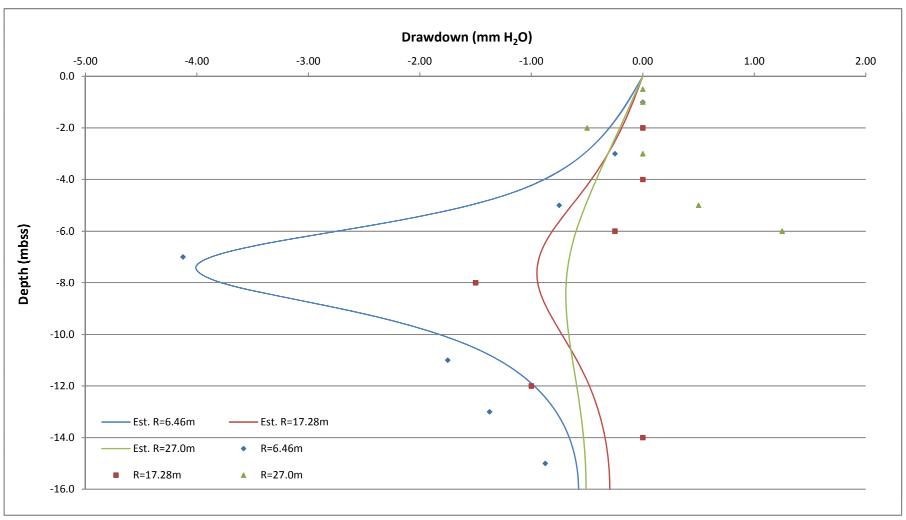
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.75E-04	0.05	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm (mm H_2O)	**CMT 146** R=17.28m (mm H_2O)	**CMT 147** R=27.0m (mm H_2O)
-0.5	-	-	0
-1	0.00	-	0
-2	-	0	-0.5
-3	-0.25	-	0
-4	-	0	-
-5	-0.75	-	0.5
-6	-	-0.25	1.25
-7	-4.13	-	-
-8	-	-1.5	-
-11	-1.75	-	-
-12	-	-1	-
-13	-1.38	-	-
-14	-	0	-
-15	-0.88	-	-
-16	-	-1	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.09	-0.06	-0.07	0.00
-1	-0.13	-0.09	-0.10	0.03
-2	-0.29	-0.18	-0.20	0.12
-3	-0.50	-0.30	-0.30	0.15
-4	-0.96	-0.49	-0.43	0.24
-5	-1.67	-0.66	-0.53	1.89
-6	-2.85	-0.82	-0.60	3.77
-7	-3.89	-0.93	-0.66	0.05
-8	-3.78	-0.94	-0.69	0.31
-11	-1.34	-0.61	-0.64	0.16
-12	-0.94	-0.46	-0.59	0.29
-13	-0.76	-0.39	-0.55	0.38
-14	-0.65	-0.34	-0.53	0.11
-15	-0.60	-0.31	-0.51	0.08
-16	-0.58	-0.30	-0.51	0.50
			Total	7.59



NOTES:
- i.e. -R=6.46m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**180909-C-VERT-3**	**FLOW RATE 5**
Client:	Syncrude Canada Ltd.	

Test Date	18-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.74E-05	1.21	999.68

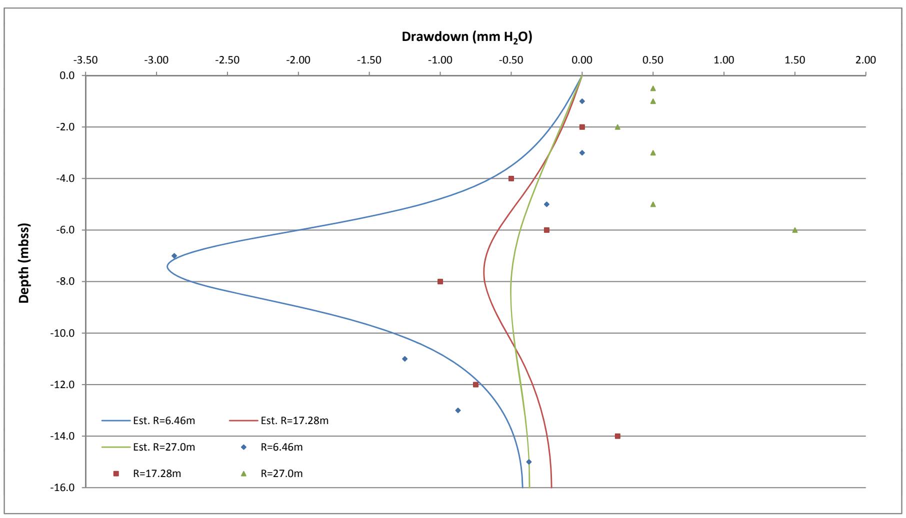
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.60E-04	0.05	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm (mm H_2O)	**CMT 146** R=17.28m (mm H_2O)	**CMT 147** R=27.0m (mm H_2O)
-0.5	-	-	0.5
-1	0.00	-	0.5
-2	-	0	0.25
-3	0.00	-	0.5
-4	-	0.5	-
-5	-0.25	-	0.5
-6	-	-0.25	1.5
-7	-2.88	-	-
-8	-	-1	-
-11	-1.25	-	-
-12	-	-0.75	-
-13	-0.88	-	-
-14	-	0.25	-
-15	-0.38	-	-
-16	-	-0.75	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.06	-0.04	-0.05	0.30
-1	-0.10	-0.06	-0.07	0.34
-2	-0.21	-0.13	-0.14	0.17
-3	-0.36	-0.22	-0.22	0.65
-4	-0.70	-0.36	-0.32	0.02
-5	-1.22	-0.48	-0.38	1.71
-6	-2.08	-0.60	-0.44	3.89
-7	-2.84	-0.68	-0.48	0.00
-8	-2.76	-0.69	-0.50	0.10
-11	-0.98	-0.44	-0.46	0.07
-12	-0.68	-0.34	-0.43	0.17
-13	-0.55	-0.28	-0.40	0.10
-14	-0.48	-0.24	-0.39	0.24
-15	-0.43	-0.22	-0.38	0.00
-16	-0.42	-0.22	-0.37	0.29
			Total	7.77



NOTES:
- i.e. -R=6.46m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**180909-C-VERT-4**	**FLOW RATE 1**
Client:	Syncrude Canada Ltd.	

Test Date	18-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.37E-02	2.07E-02
1.89E-02	2.86E-02
1.37E-02	2.07E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.75E-05	1.20	999.68

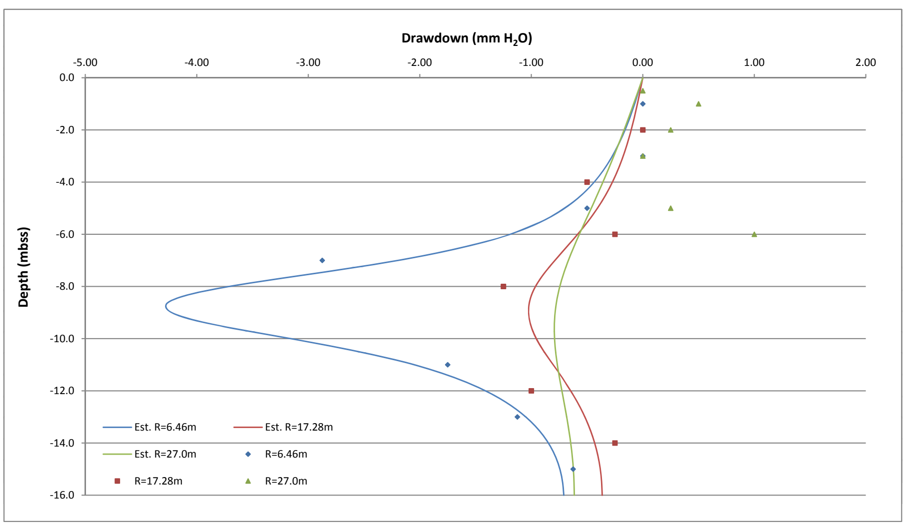
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.25E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm (mm H_2O)	**CMT 146** R=17.28m (mm H_2O)	**CMT 147** R=27.0m (mm H_2O)
-0.5	-	-	0
-1	0.00	-	0.5
-2	-	0	0.25
-3	0.00	-	0
-4	-	0.5	-
-5	-0.50	-	0.25
-6	-	-0.25	1
-7	-2.88	-	-
-8	-	-1.25	-
-11	-1.75	-	-
-12	-	-1	-
-13	-1.13	-	-
-14	-	-0.25	-
-15	-0.63	-	-
-16	-	-1	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.05	-0.03	-0.05	0.00
-1	-0.07	-0.05	-0.08	0.34
-2	-0.15	-0.10	-0.16	0.18
-3	-0.26	-0.17	-0.25	0.13
-4	-0.47	-0.29	-0.37	0.04
-5	-0.75	-0.43	-0.48	0.59
-6	-1.24	-0.60	-0.58	2.61
-7	-2.25	-0.80	-0.67	0.39
-8	-3.71	-0.96	-0.74	0.08
-11	-2.15	-0.82	-0.77	0.16
-12	-1.34	-0.62	-0.72	0.14
-13	-1.02	-0.51	-0.68	0.01
-14	-0.84	-0.43	-0.64	0.03
-15	-0.74	-0.38	-0.62	0.01
-16	-0.71	-0.36	-0.61	0.40
			Total	4.72



NOTES:
- i.e. -R=6.46m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

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Packer Test:	**180909-C-VERT-4**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	18-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.37E-02	2.07E-02
1.89E-02	2.86E-02
1.37E-02	2.07E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.75E-05	1.20	999.68

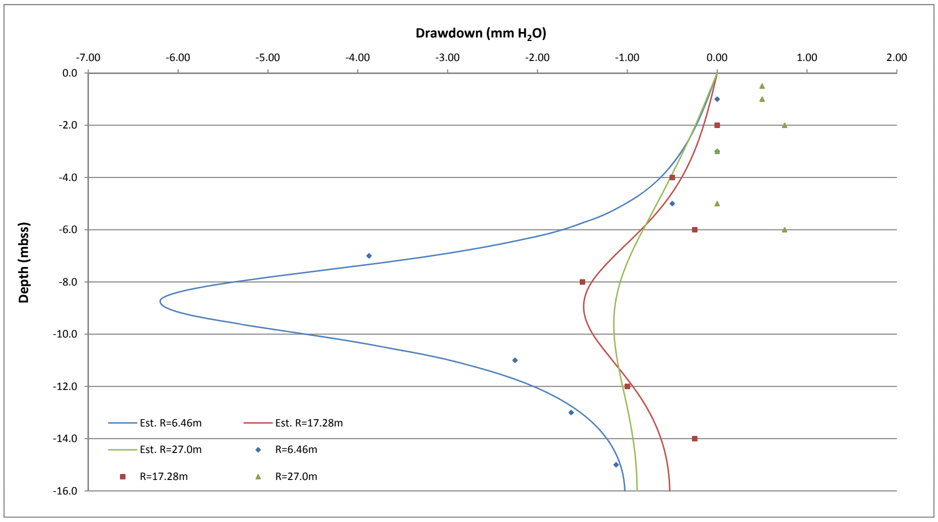
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.25E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	0.5
-1	0.00	-	0.5
-2	-	0	0.75
-3	0.00	-	0
-4	-	0.5	-
-5	-0.50	-	0
-6	-	-0.25	0.75
-7	-3.88	-	-
-8	-	-1.5	-
-11	-2.25	-	-
-12	-	-1	-
-13	-1.63	-	-
-14	-	-0.25	-
-15	-1.13	-	-
-16	-	-0.25	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.07	-0.04	-0.08	0.33
-1	-0.10	-0.07	-0.11	0.39
-2	-0.22	-0.14	-0.23	0.99
-3	-0.37	-0.24	-0.36	0.27
-4	-0.68	-0.42	-0.54	0.01
-5	-1.08	-0.62	-0.69	0.81
-6	-1.80	-0.87	-0.84	2.90
-7	-3.27	-1.15	-0.97	0.37
-8	-5.38	-1.40	-1.08	0.01
-11	-3.12	-1.20	-1.12	0.76
-12	-1.94	-0.91	-1.04	0.01
-13	-1.47	-0.73	-0.98	0.02
-14	-1.21	-0.62	-0.93	0.14
-15	-1.07	-0.55	-0.90	0.00
-16	-1.03	-0.53	-0.89	0.08
			Total	7.02



NOTES:

- i.e. -R=6.46m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test: **180909-C-VERT-4** **FLOW RATE 3**

Client: Syncrude Canada Ltd.

Test Date	18-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.37E-02	2.07E-02
1.89E-02	2.86E-02
1.37E-02	2.07E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.75E-05	1.20	999.68

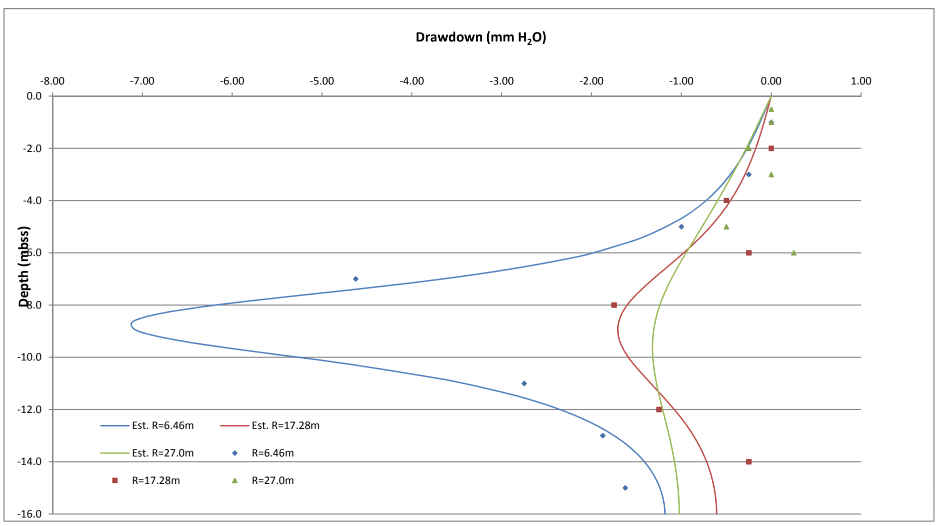
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.50E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm (mm H_2O)	**CMT 146** R=17.28m (mm H_2O)	**CMT 147** R=27.0m (mm H_2O)
-0.5	-	-	0
-1	0.00	-	0
-2	-	0	-0.25
-3	-0.25	-	0
-4	-	0	-
-5	-1.00	-	-0.5
-6	-	-0.25	0.25
-7	-4.63	-	-
-8	-	-1.75	-
-11	-2.75	-	-
-12	-	-1.25	-
-13	-1.88	-	-
-14	-	-0.25	-
-15	-1.63	-	-
-16	-	-1	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.08	-0.05	-0.09	0.01
-1	-0.12	-0.08	-0.13	0.03
-2	-0.26	-0.17	-0.27	0.03
-3	-0.43	-0.28	-0.41	0.20
-4	-0.78	-0.49	-0.62	0.00
-5	-1.24	-0.71	-0.79	0.15
-6	-2.07	-1.00	-0.96	2.03
-7	-3.75	-1.33	-1.12	0.76
-8	-6.18	-1.60	-1.24	0.02
-11	-3.59	-1.37	-1.28	0.70
-12	-2.23	-1.04	-1.20	0.04
-13	-1.69	-0.84	-1.13	0.03
-14	-1.40	-0.71	-1.07	0.21
-15	-1.23	-0.63	-1.04	0.15
-16	-1.18	-0.61	-1.02	0.15
			Total	4.37



NOTES:

- i.e. -R=6.46m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

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Packer Test: **180909-C-VERT-4** **FLOW RATE 4**

Client: Syncrude Canada Ltd.

Test Date	18-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.37E-02	2.07E-02
1.89E-02	2.86E-02
1.37E-02	2.07E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.75E-05	1.20	999.68

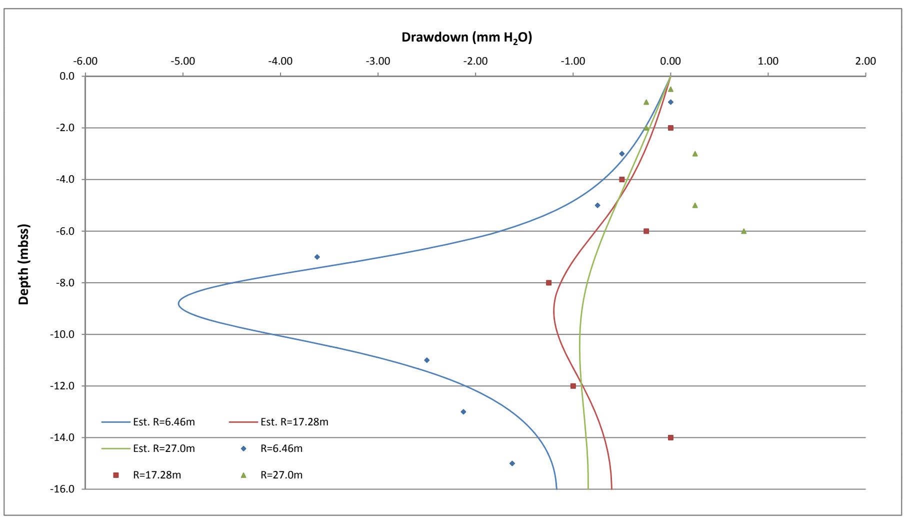
K_{gx} (m/s)	A_{gr} (-)	**KD** (-)
1.25E-04	0.06	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm (mm H_2O)	**CMT 146** R=17.28m (mm H_2O)	**CMT 147** R=27.0m (mm H_2O)
-0.5	-	-	0
-1	0.00	-	-0.25
-2	-	0	-0.25
-3	-0.50	-	0.25
-4	-	-0.25	-
-5	-0.75	-	0.25
-6	-	-0.25	0.75
-7	-3.63	-	-
-8	-	-1.25	-
-11	-2.50	-	-
-12	-	-1	-
-13	-2.13	-	-
-14	-	0	-
-15	-1.63	-	-
-16	-	-1	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.08	-0.05	-0.07	0.00
-1	-0.12	-0.08	-0.10	0.04
-2	-0.25	-0.16	-0.21	0.03
-3	-0.42	-0.26	-0.32	0.33
-4	-0.74	-0.43	-0.46	0.00
-5	-1.14	-0.60	-0.58	0.84
-6	-1.81	-0.79	-0.68	2.34
-7	-3.01	-0.98	-0.78	0.37
-8	-4.49	-1.13	-0.86	0.01
-11	-3.01	-1.06	-0.93	0.26
-12	-2.01	-0.88	-0.91	0.01
-13	-1.59	-0.76	-0.89	0.29
-14	-1.34	-0.68	-0.87	0.46
-15	-1.21	-0.62	-0.85	0.17
-16	-1.17	-0.60	-0.84	0.16
			Total	5.16



NOTES:

- i.e. -R=6.46m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test: **180909-C-VERT-4** **FLOW RATE 5**

Client: Syncrude Canada Ltd.

Test Date	18-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.37E-02	2.07E-02
1.89E-02	2.86E-02
1.37E-02	2.07E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.75E-05	1.20	999.68

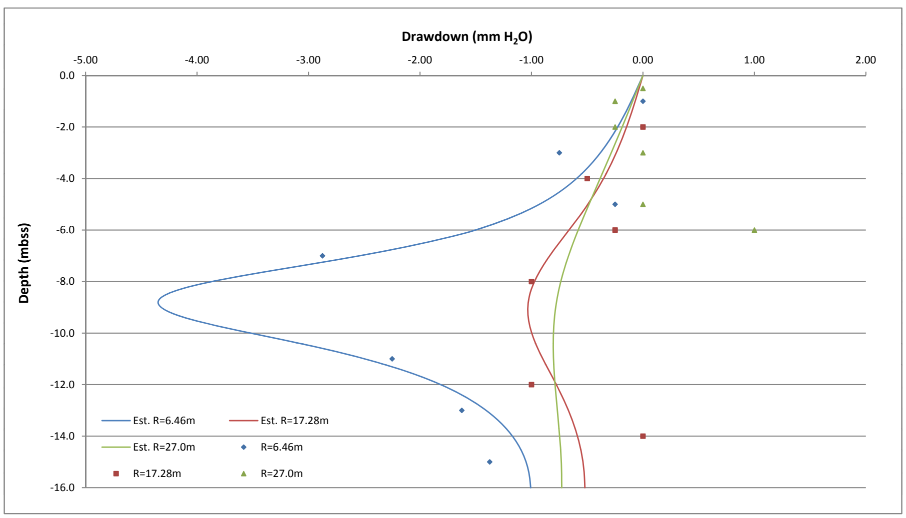
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.00E-04	0.06	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm (mm H_2O)	**CMT 146** R=17.28m (mm H_2O)	**CMT 147** R=27.0m (mm H_2O)
-0.5	-	-	0
-1	0.00	-	-0.25
-2	-	0	-0.25
-3	-0.75	-	0
-4	-	-0.25	-
-5	-0.25	-	0
-6	-	-0.25	1
-7	-2.88	-	-
-8	-	-1	-
-11	-2.25	-	-
-12	-	-1	-
-13	-1.63	-	-
-14	-	0	-
-15	-1.38	-	-
-16	-	-1	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.07	-0.04	-0.06	0.00
-1	-0.10	-0.07	-0.09	0.04
-2	-0.22	-0.14	-0.18	0.02
-3	-0.36	-0.23	-0.27	0.23
-4	-0.64	-0.37	-0.40	0.02
-5	-0.98	-0.51	-0.50	0.79
-6	-1.56	-0.68	-0.59	2.71
-7	-2.60	-0.84	-0.67	0.08
-8	-3.87	-0.97	-0.74	0.00
-11	-2.60	-0.91	-0.80	0.12
-12	-1.74	-0.76	-0.78	0.06
-13	-1.37	-0.66	-0.76	0.07
-14	-1.16	-0.58	-0.75	0.34
-15	-1.05	-0.54	-0.73	0.11
-16	-1.01	-0.52	-0.73	0.23
			Total	4.57



NOTES:

- i.e. -R=6.46m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

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Packer Test: **180909-C-VERT-5** **FLOW RATE 1**

Client: Syncrude Canada Ltd.

Test Date	18-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.46E-02	2.21E-02
1.89E-02	2.86E-02
1.46E-02	2.21E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.75E-05	1.20	999.68

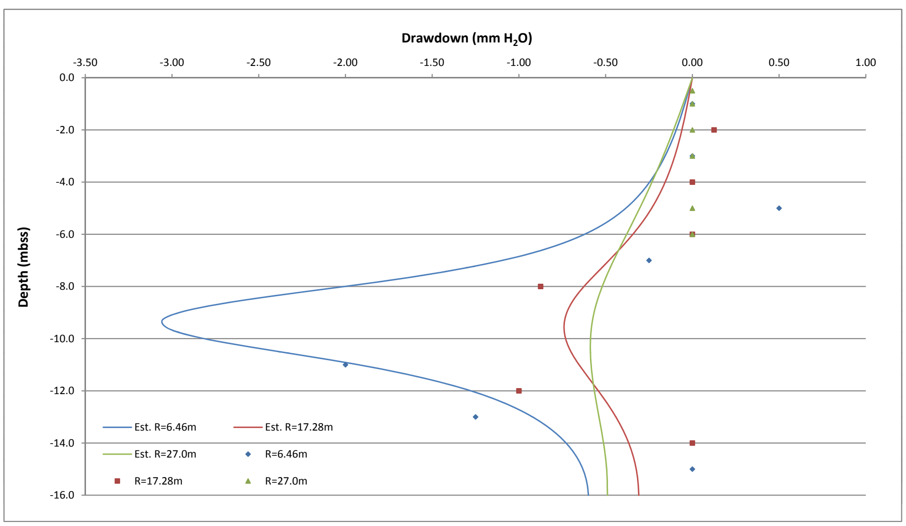
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.75E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	0
-1	0.00	-	0
-2	-	0.125	0
-3	0.00	-	0
-4	-	0	-
-5	0.50	-	0
-6	-	0	0
-7	-0.25	-	-
-8	-	-0.875	-
-11	-2.00	-	-
-12	-	-1	-
-13	-1.25	-	-
-14	-	0	-
-15	0.00	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.03	-0.02	-0.03	0.00
-1	-0.04	-0.03	-0.05	0.00
-2	-0.09	-0.06	-0.10	0.04
-3	-0.15	-0.10	-0.16	0.05
-4	-0.26	-0.17	-0.24	0.03
-5	-0.41	-0.25	-0.31	0.92
-6	-0.65	-0.35	-0.39	0.27
-7	-1.12	-0.49	-0.46	0.75
-8	-2.00	-0.62	-0.52	0.06
-11	-2.02	-0.67	-0.59	0.00
-12	-1.21	-0.53	-0.56	0.23
-13	-0.89	-0.43	-0.53	0.13
-14	-0.72	-0.36	-0.51	0.13
-15	-0.63	-0.32	-0.50	0.39
-16	-0.60	-0.31	-0.49	0.10
			Total	3.01



NOTES:

- i.e. -R=6.46m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

UNIVERSITY OF SASKATCHEWAN

Packer Test:	**180909-C-VERT-5**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	18-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.46E-02	2.21E-02
1.89E-02	2.86E-02
1.46E-02	2.21E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.75E-05	1.20	999.68

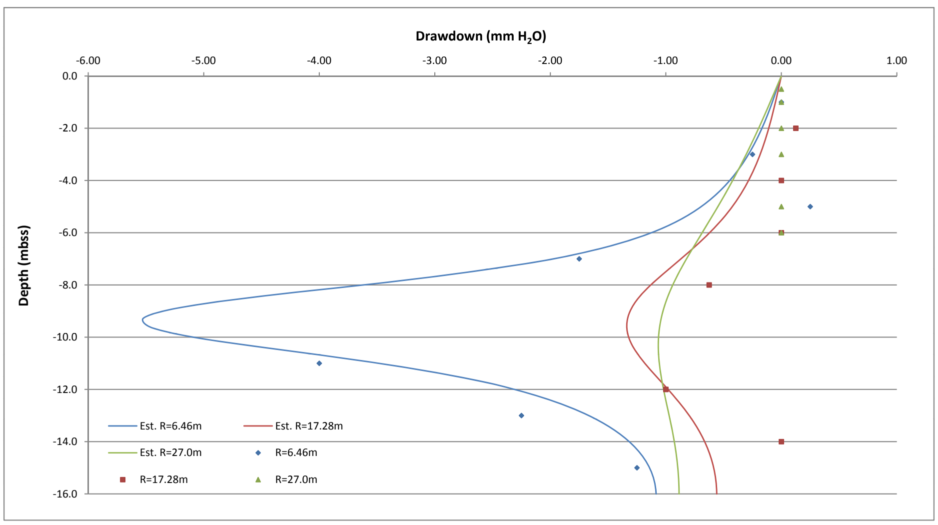
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.50E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	CMT 145 R=6.46mm (mm H_2O)	CMT 146 R=17.28m (mm H_2O)	CMT 147 R=27.0m (mm H_2O)
-0.5	-	-	0
-1	0.00	-	0
-2	-	0.125	0
-3	-0.25	-	0
-4	-	0	-
-5	0.25	-	0
-6	-	0	0
-7	-1.75	-	-
-8	-	-0.625	-
-11	-4.00	-	-
-12	-	-1	-
-13	-2.25	-	-
-14	-	0	-
-15	-1.25	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	CMT 144 R=7.15m TH (mm H_2O)	CMT 147 R=31.0m TH (mm H_2O)	CMT 143 R=46.0m TH (mm H_2O)	SLS (mm^2 H_2O)
-0.5	-0.05	-0.03	-0.06	0.00
-1	-0.08	-0.05	-0.09	0.01
-2	-0.16	-0.10	-0.19	0.09
-3	-0.27	-0.17	-0.29	0.08
-4	-0.48	-0.30	-0.44	0.09
-5	-0.74	-0.45	-0.57	1.29
-6	-1.17	-0.64	-0.70	0.89
-7	-2.02	-0.88	-0.83	0.07
-8	-3.62	-1.13	-0.94	0.26
-11	-3.66	-1.20	-1.06	0.11
-12	-2.18	-0.95	-1.01	0.00
-13	-1.62	-0.78	-0.97	0.40
-14	-1.30	-0.66	-0.92	0.43
-15	-1.14	-0.58	-0.90	0.01
-16	-1.08	-0.56	-0.89	0.31
			Total	3.76



NOTES:

- i.e. -R=6.46m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**180909-C-VERT-5**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	18-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.46E-02	2.21E-02
1.89E-02	2.86E-02
1.46E-02	2.21E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.75E-05	1.20	999.68

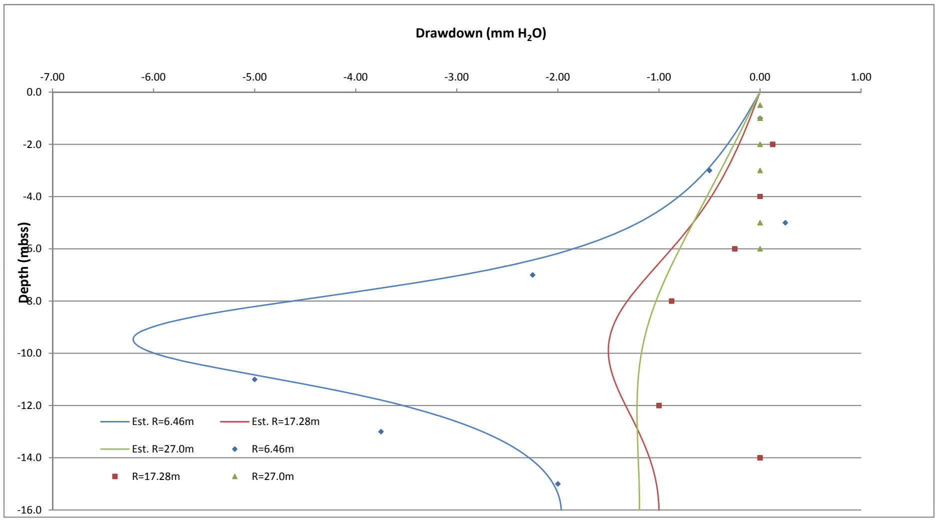
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.25E-04	0.075	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	0
-1	0.00	-	0
-2	-	0.125	0
-3	-0.50	-	0
-4	-	0	-
-5	0.25	-	0
-6	-	-0.25	0
-7	-2.25	-	-
-8	-	-0.875	-
-11	-5.00	-	-
-12	-	-1	-
-13	-3.75	-	-
-14	-	0	-
-15	-2.00	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.10	-0.06	-0.08	0.01
-1	-0.15	-0.10	-0.12	0.04
-2	-0.31	-0.20	-0.25	0.17
-3	-0.50	-0.32	-0.37	0.14
-4	-0.86	-0.51	-0.55	0.26
-5	-1.27	-0.69	-0.68	2.77
-6	-1.91	-0.89	-0.81	1.06
-7	-3.00	-1.11	-0.92	0.57
-8	-4.63	-1.31	-1.03	0.19
-11	-4.92	-1.46	-1.20	0.01
-12	-3.38	-1.31	-1.22	0.10
-13	-2.68	-1.19	-1.21	1.15
-14	-2.26	-1.09	-1.20	1.18
-15	-2.04	-1.02	-1.20	0.00
-16	-1.97	-1.00	-1.19	1.00
			Total	7.63



NOTES:

- i.e. -R=6.46m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**180909-C-VERT-5**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	18-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.46E-02	2.21E-02
1.89E-02	2.86E-02
1.46E-02	2.21E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.75E-05	1.20	999.68

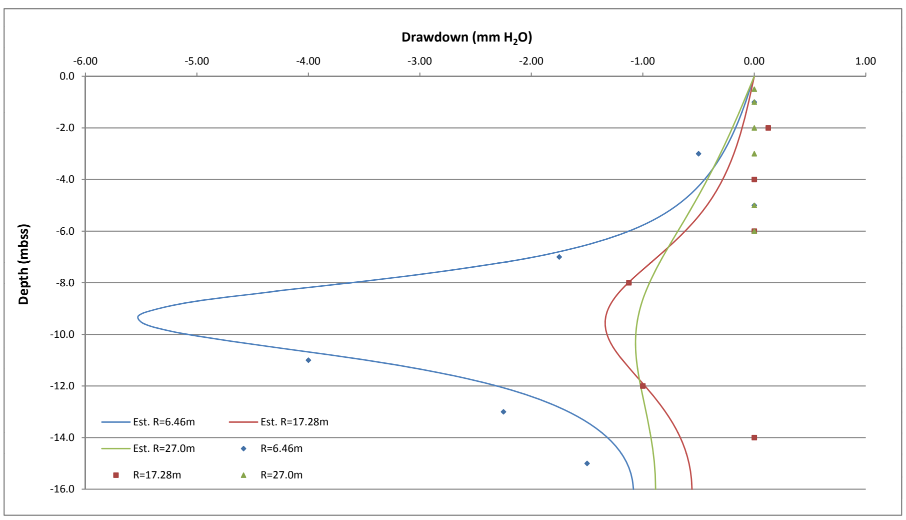
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.50E-04	0.04	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	0
-1	0.00	-	0
-2	-	0.125	0
-3	-0.50	-	0
-4	-	0	-
-5	0.00	-	0
-6	-	0	0
-7	-1.75	-	-
-8	-	-1.125	-
-11	-4.00	-	-
-12	-	-1	-
-13	-2.25	-	-
-14	-	0	-
-15	-1.50	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.05	-0.03	-0.06	0.00
-1	-0.08	-0.05	-0.09	0.01
-2	-0.16	-0.10	-0.19	0.09
-3	-0.27	-0.17	-0.29	0.14
-4	-0.48	-0.30	-0.44	0.09
-5	-0.74	-0.45	-0.57	0.86
-6	-1.17	-0.64	-0.70	0.89
-7	-2.02	-0.88	-0.83	0.07
-8	-3.62	-1.13	-0.94	0.00
-11	-3.66	-1.20	-1.06	0.11
-12	-2.18	-0.95	-1.01	0.00
-13	-1.62	-0.78	-0.97	0.40
-14	-1.30	-0.66	-0.92	0.43
-15	-1.14	-0.58	-0.90	0.13
-16	-1.08	-0.56	-0.89	0.31
			Total	3.24



NOTES:
- i.e. -R=6.46m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**180909-C-VERT-5**	**FLOW RATE 5**
Client:	Syncrude Canada Ltd.	

Test Date	18-Sep-09
Test Interval Temperature (^{o}C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.46E-02	2.21E-02
1.89E-02	2.86E-02
1.46E-02	2.21E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	μ_w (kg/m^3)
1.75E-05	1.20	999.68

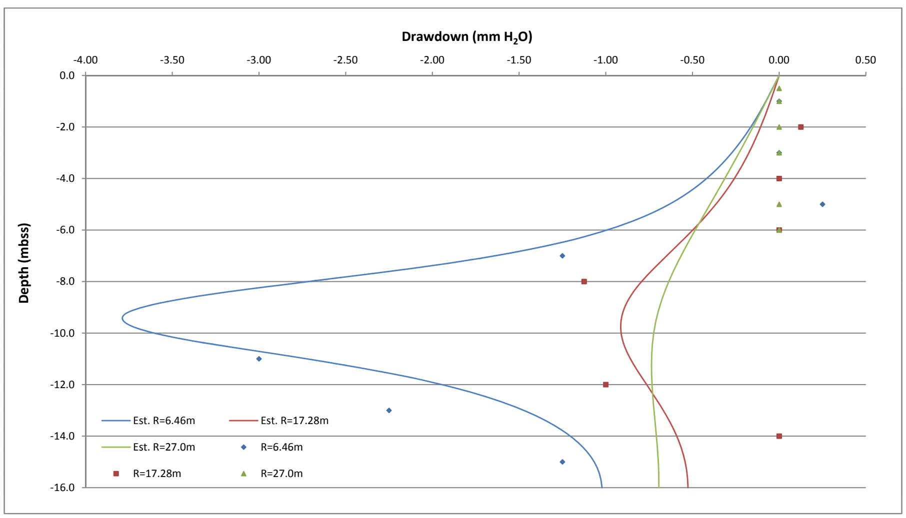
K_{gx} (m/s)	A_{gr} (-)	**KD** (-)
1.15E-04	0.06	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm (mm H_2O)	**CMT 146** R=17.28m (mm H_2O)	**CMT 147** R=27.0m (mm H_2O)
-0.5	-	-	0
-1	0.00	-	0
-2	-	0.125	0
-3	0.00	-	0
-4	-	0	-
-5	0.25	-	0
-6	-	0	0
-7	-1.25	-	-
-8	-	-1.125	-
-11	-3.00	-	-
-12	-	-1	-
-13	-2.25	-	-
-14	-	0	-
-15	-1.25	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.05	-0.03	-0.05	0.00
-1	-0.07	-0.05	-0.07	0.01
-2	-0.16	-0.10	-0.15	0.07
-3	-0.26	-0.17	-0.22	0.12
-4	-0.45	-0.27	-0.33	0.07
-5	-0.67	-0.38	-0.41	1.02
-6	-1.03	-0.51	-0.49	0.50
-7	-1.67	-0.66	-0.57	0.18
-8	-2.71	-0.79	-0.64	0.11
-11	-2.84	-0.87	-0.74	0.03
-12	-1.85	-0.75	-0.73	0.06
-13	-1.43	-0.66	-0.72	0.67
-14	-1.19	-0.59	-0.71	0.34
-15	-1.06	-0.54	-0.70	0.04
-16	-1.02	-0.53	-0.69	0.28
			Total	3.21



NOTES:
- i.e. -R=6.46m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test: **200909-C-ANG-1** **FLOW RATE 1**

Syncrude

Client: Syncrude Canada Ltd.

Test Date	20-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	Flux (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.76E-05	1.20	999.68

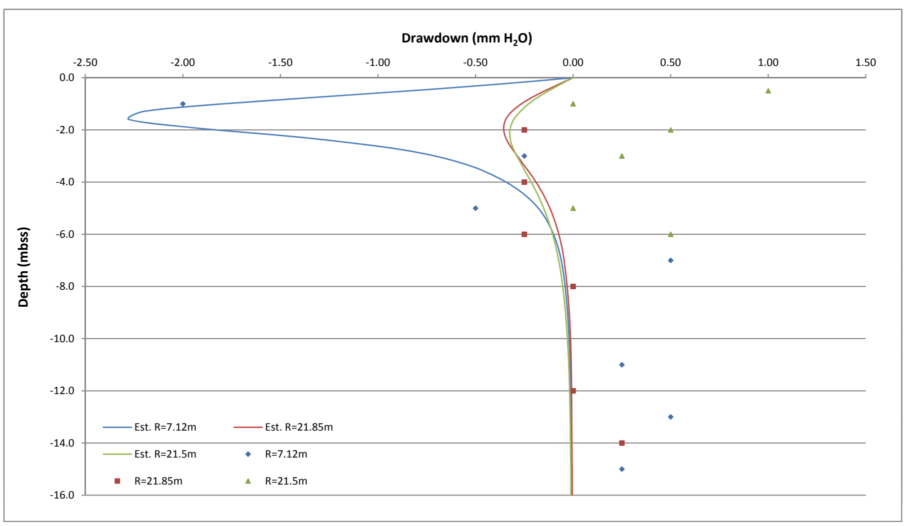
K_{gx} (m/s)	A_{gr} (-)	KD (-)
4.00E-04	0.01	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	CMT 145 R=7.12mm ($mm\ H_2O$)	CMT 146 R=21.85m ($mm\ H_2O$)	CMT 147 R=21.5m ($mm\ H_2O$)
-0.5	-	-	1
-1	-2.00	-	0
-2	-	-0.25	0.5
-3	-0.25	-	0.25
-4	-	0	-
-5	-0.50	-	0
-6	-	-0.25	0.5
-7	0.50	-	-
-8	-	0	-
-11	0.25	-	-
-12	-	0	-
-13	0.50	-	-
-14	-	0.25	-
-15	0.25	-	-
-16	-	0.5	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	CMT 144 R=7.12mm TH ($mm\ H_2O$)	CMT 147 R=21.85m TH ($mm\ H_2O$)	CMT 143 R=21.5m TH ($mm\ H_2O$)	SLS ($mm^2\ H_2O$)
-0.5	-1.10	-0.18	-0.16	1.34
-1	-1.73	-0.26	-0.22	0.12
-2	-1.94	-0.36	-0.32	0.69
-3	-0.78	-0.30	-0.30	0.58
-4	-0.31	-0.18	-0.20	0.01
-5	-0.17	-0.11	-0.14	0.13
-6	-0.10	-0.07	-0.10	0.39
-7	-0.06	-0.04	-0.07	0.31
-8	-0.04	-0.03	-0.05	0.00
-11	-0.02	-0.01	-0.02	0.07
-12	-0.01	-0.01	-0.02	0.00
-13	-0.01	-0.01	-0.01	0.26
-14	-0.01	-0.01	-0.01	0.07
-15	-0.01	0.00	-0.01	0.07
-16	0.00	0.00	-0.01	0.25
			Total	4.04



NOTES:

- i.e. -R=7.12m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

University of Saskatchewan

Packer Test:	**200909-C-ANG-1**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	20-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.76E-05	1.20	999.68

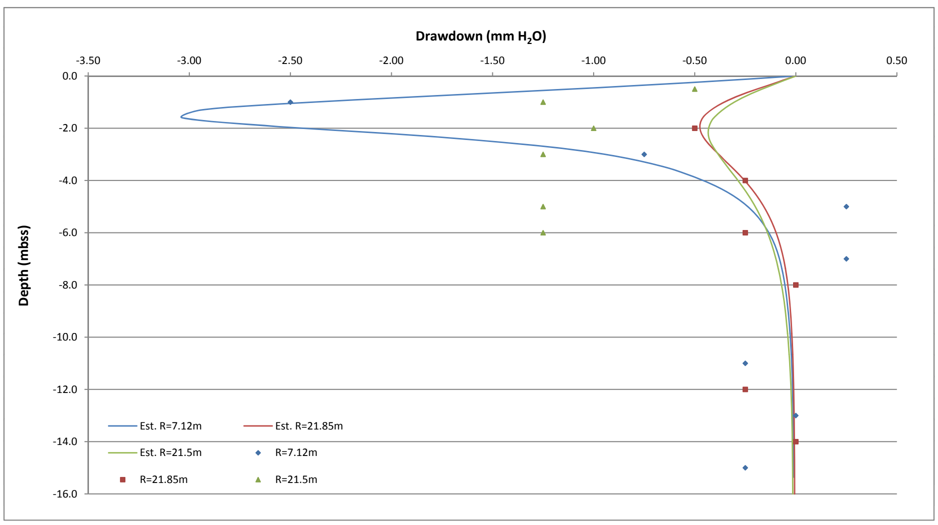
K_{gx} (m/s)	A_{gr} (-)	KD (-)
4.50E-04	0.01	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm (mm H_2O)	**CMT 146** R=17.28m (mm H_2O)	**CMT 147** R=27.0m (mm H_2O)
-0.5	-	-	-0.5
-1	-2.50	-	-1.25
-2	-	-0.5	-1
-3	-0.75	-	-1.25
-4	-	-1.25	-
-5	0.25	-	-1.25
-6	-	-0.25	-1.25
-7	0.25	-	-
-8	-	0	-
-11	-0.25	-	-
-12	-	-0.25	-
-13	0.00	-	-
-14	-	0	-
-15	-0.25	-	-
-16	-	1	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-1.46	-0.24	-0.21	0.08
-1	-2.30	-0.34	-0.30	0.95
-2	-2.59	-0.47	-0.43	0.33
-3	-1.04	-0.40	-0.39	0.82
-4	-0.41	-0.24	-0.27	0.00
-5	-0.22	-0.15	-0.19	1.34
-6	-0.13	-0.09	-0.14	1.27
-7	-0.08	-0.06	-0.10	0.11
-8	-0.05	-0.04	-0.07	0.00
-11	-0.02	-0.01	-0.03	0.05
-12	-0.02	-0.01	-0.02	0.06
-13	-0.01	-0.01	-0.02	0.00
-14	-0.01	-0.01	-0.02	0.00
-15	-0.01	-0.01	-0.02	0.06
-16	0.00	-0.01	-0.01	1.01
			Total	5.07



NOTES:
- i.e. -R=7.12m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

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Packer Test:	**200909-C-ANG-1**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	20-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.76E-05	1.20	999.68

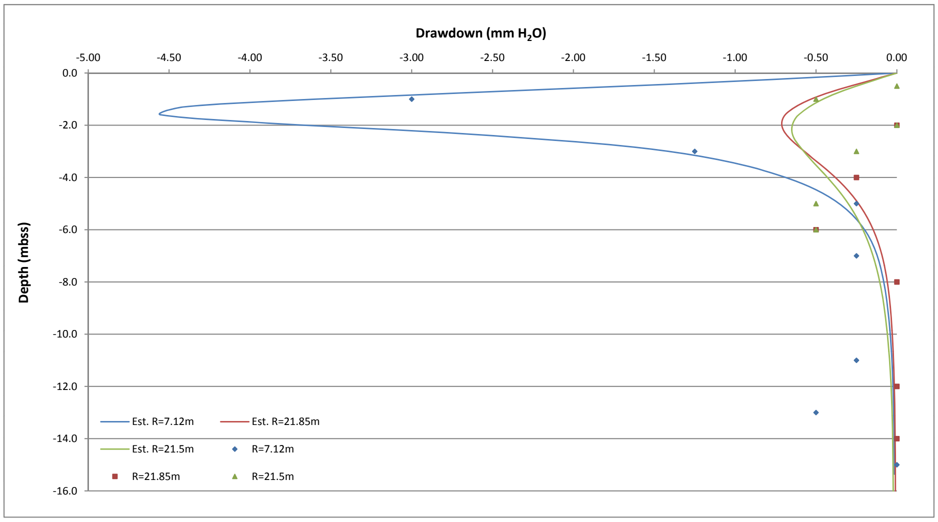
K_{gx} (m/s)	A_{gr} (-)	KD (-)
4.00E-04	0.01	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	0
-1	-3.00	-	-0.5
-2	-	0	0
-3	-1.25	-	-0.25
-4	-	-0.5	-
-5	-0.25	-	-0.5
-6	-	-0.5	-0.5
-7	-0.25	-	-
-8	-	0	-
-11	-0.25	-	-
-12	-	0	-
-13	-0.50	-	-
-14	-	0	-
-15	0.00	-	-
-16	-	1.5	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-2.19	-0.36	-0.31	0.10
-1	-3.45	-0.51	-0.44	0.21
-2	-3.89	-0.71	-0.64	0.92
-3	-1.57	-0.59	-0.59	0.22
-4	-0.61	-0.35	-0.41	0.01
-5	-0.33	-0.22	-0.29	0.05
-6	-0.19	-0.14	-0.20	0.22
-7	-0.12	-0.09	-0.15	0.02
-8	-0.08	-0.06	-0.11	0.00
-11	-0.03	-0.02	-0.05	0.05
-12	-0.02	-0.02	-0.03	0.00
-13	-0.02	-0.01	-0.03	0.23
-14	-0.02	-0.01	-0.03	0.00
-15	-0.01	-0.01	-0.02	0.00
-16	0.00	-0.01	-0.02	2.28
			Total	2.02



NOTES:

- i.e. -R=7.12m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**200909-C-ANG-1**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	20-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.76E-05	1.20	999.68

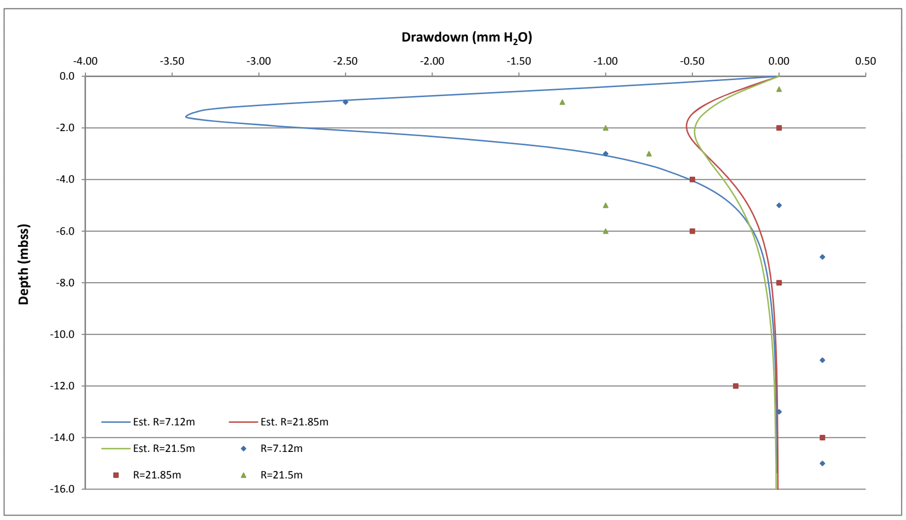
K_{gx} (m/s)	**A_{gr}** (-)	**KD** (-)
4.00E-04	0.01	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm (mm H_2O)	**CMT 146** R=17.28m (mm H_2O)	**CMT 147** R=27.0m (mm H_2O)
-0.5	-	-	0
-1	-2.50	-	-1.25
-2	-	0	-1
-3	-1.00	-	-0.75
-4	-	-1.25	-
-5	0.00	-	-1
-6	-	-0.5	-1
-7	0.25	-	-
-8	-	0	-
-11	0.25	-	-
-12	-	-0.25	-
-13	0.00	-	-
-14	-	0.25	-
-15	0.25	-	-
-16	-	1	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-1.65	-0.27	-0.24	0.06
-1	-2.59	-0.38	-0.33	0.85
-2	-2.92	-0.53	-0.48	0.55
-3	-1.17	-0.45	-0.44	0.12
-4	-0.46	-0.27	-0.31	0.05
-5	-0.25	-0.17	-0.22	0.68
-6	-0.14	-0.11	-0.15	0.87
-7	-0.09	-0.07	-0.11	0.12
-8	-0.06	-0.04	-0.08	0.00
-11	-0.02	-0.02	-0.03	0.07
-12	-0.02	-0.01	-0.03	0.06
-13	-0.01	-0.01	-0.02	0.00
-14	-0.01	-0.01	-0.02	0.07
-15	-0.01	-0.01	-0.02	0.07
-16	0.00	-0.01	-0.02	1.01
			Total	3.57



NOTES:
- i.e. -R=7.12m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**200909-C-ANG-1**	**FLOW RATE 5**
Client:	Syncrude Canada Ltd.	

Test Date	20-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.76E-05	1.20	999.68

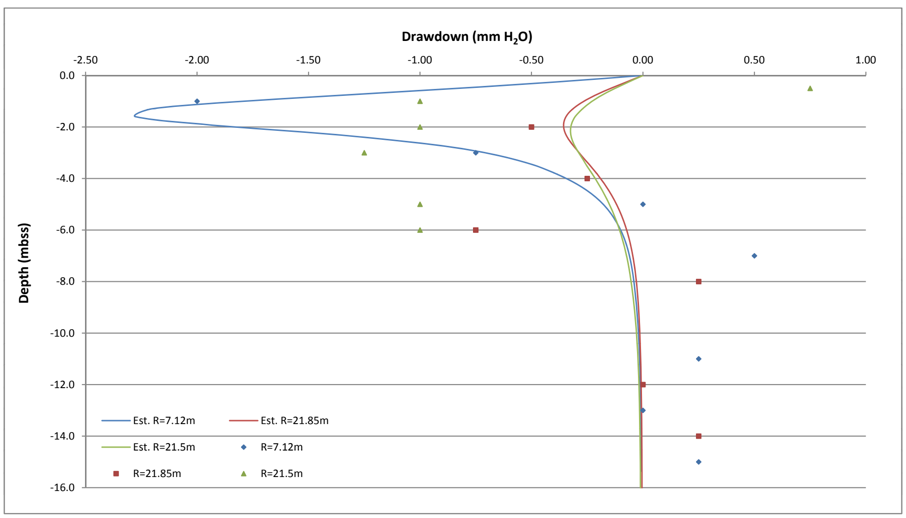
K_{gx} (m/s)	A_{gr} (-)	**KD** (-)
4.00E-04	0.01	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	0.75
-1	-2.00	-	-1
-2	-	-0.5	-1
-3	-0.75	-	-1.25
-4	-	-1	-
-5	0.00	-	-1
-6	-	-0.75	-1
-7	0.50	-	-
-8	-	0.25	-
-11	0.25	-	-
-12	-	0	-
-13	0.00	-	-
-14	-	0.25	-
-15	0.25	-	-
-16	-	0.25	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-1.10	-0.18	-0.16	0.82
-1	-1.73	-0.26	-0.22	0.68
-2	-1.94	-0.36	-0.32	0.48
-3	-0.78	-0.30	-0.30	0.91
-4	-0.31	-0.18	-0.20	0.01
-5	-0.17	-0.11	-0.14	0.76
-6	-0.10	-0.07	-0.10	1.27
-7	-0.06	-0.04	-0.07	0.31
-8	-0.04	-0.03	-0.05	0.00
-11	-0.02	-0.01	-0.02	0.07
-12	-0.01	-0.01	-0.02	0.00
-13	-0.01	-0.01	-0.01	0.00
-14	-0.01	-0.01	-0.01	0.07
-15	-0.01	0.00	-0.01	0.07
-16	0.00	0.00	-0.01	0.06
			Total	5.45



NOTES:

- i.e. -R=7.12m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test: **200909-C-ANG-2** **FLOW RATE 1**

Client: Syncrude Canada Ltd.

Test Date	20-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	Flux (m/s)
4.72E-03	7.14E-03
9.44E-03	1.43E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02
4.72E-03	7.14E-03

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.74E-05	1.21	999.68

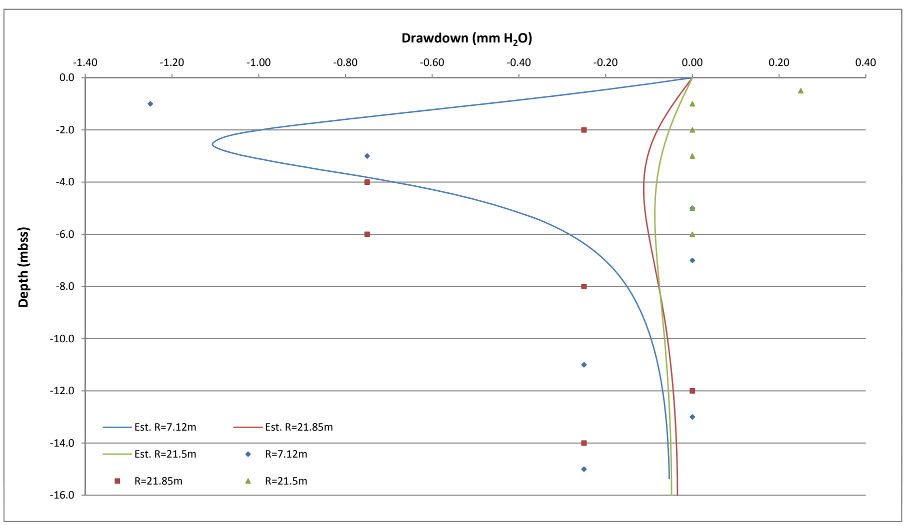
K_{gx} (m/s)	A_{gr} (-)	KD (-)
1.75E-04	0.075	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	CMT 145 R=7.12mm ($mm\ H_2O$)	CMT 146 R=21.85m ($mm\ H_2O$)	CMT 147 R=21.5m ($mm\ H_2O$)
-0.5	-	-	0.25
-1	-1.25	-	0
-2	-	-0.25	0
-3	-0.75	-	0
-4	-	0	-
-5	0.00	-	0
-6	-	-0.75	0
-7	0.00	-	-
-8	-	-0.25	-
-11	-0.25	-	-
-12	-	0	-
-13	0.00	-	-
-14	-	-0.25	-
-15	-0.25	-	-
-16	-	1.5	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	CMT 144 R=7.12mm TH ($mm\ H_2O$)	CMT 147 R=21.85m TH ($mm\ H_2O$)	CMT 143 R=21.5m TH ($mm\ H_2O$)	SLS ($mm^2\ H_2O$)
-0.5	-0.29	-0.03	-0.02	0.07
-1	-0.45	-0.04	-0.03	0.64
-2	-0.96	-0.08	-0.05	0.03
-3	-1.06	-0.10	-0.07	0.10
-4	-0.64	-0.11	-0.08	0.41
-5	-0.41	-0.11	-0.09	0.18
-6	-0.28	-0.10	-0.09	0.43
-7	-0.20	-0.09	-0.08	0.04
-8	-0.15	-0.08	-0.08	0.01
-11	-0.08	-0.05	-0.06	0.03
-12	-0.07	-0.04	-0.05	0.00
-13	-0.06	-0.04	-0.05	0.00
-14	-0.06	-0.04	-0.05	0.05
-15	-0.05	-0.04	-0.05	0.04
-16	0.00	-0.03	-0.05	2.35
			Total	2.02



NOTES:

- i.e. -R=7.12m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

University of Saskatchewan

Packer Test:	**200909-C-ANG-2**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	20-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
4.72E-03	7.14E-03
9.44E-03	1.43E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02
4.72E-03	7.14E-03

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.74E-05	1.21	999.68

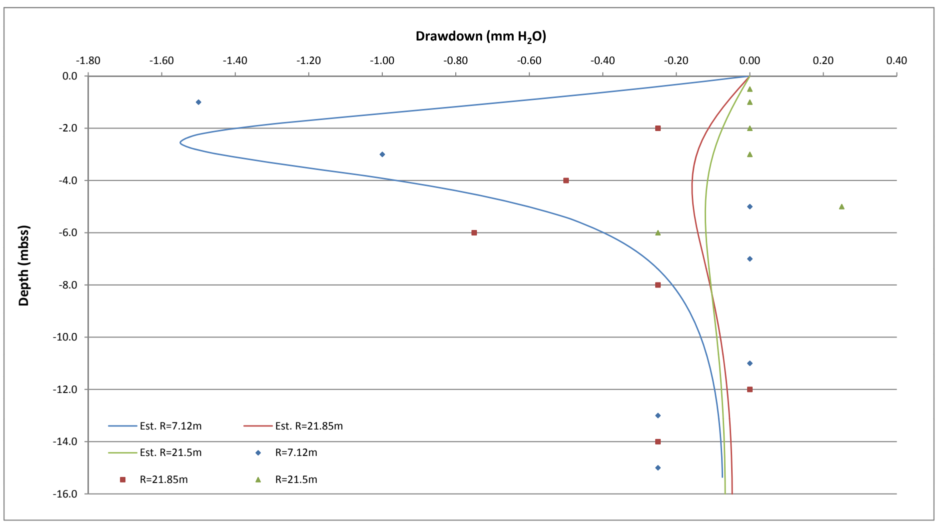
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.50E-04	0.075	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	0
-1	-1.50	-	0
-2	-	-0.25	0
-3	-1.00	-	0
-4	-	0	-
-5	0.00	-	0.25
-6	-	-0.75	-0.25
-7	0.00	-	-
-8	-	-0.25	-
-11	0.00	-	-
-12	-	0	-
-13	-0.25	-	-
-14	-	-0.25	-
-15	-0.25	-	-
-16	-	-0.25	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.41	-0.04	-0.03	0.00
-1	-0.63	-0.06	-0.04	0.75
-2	-1.35	-0.11	-0.07	0.03
-3	-1.49	-0.14	-0.10	0.25
-4	-0.89	-0.16	-0.12	0.12
-5	-0.57	-0.15	-0.12	0.47
-6	-0.39	-0.14	-0.12	0.39
-7	-0.28	-0.12	-0.11	0.08
-8	-0.21	-0.11	-0.11	0.01
-11	-0.11	-0.07	-0.08	0.01
-12	-0.09	-0.06	-0.08	0.00
-13	-0.08	-0.06	-0.07	0.03
-14	-0.08	-0.05	-0.07	0.04
-15	-0.08	-0.05	-0.07	0.03
-16	0.00	-0.05	-0.07	0.04
			Total	2.20



NOTES:
- i.e. -R=7.12m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**200909-C-ANG-2**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	20-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
4.72E-03	7.14E-03
9.44E-03	1.43E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02
4.72E-03	7.14E-03

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.74E-05	1.21	999.68

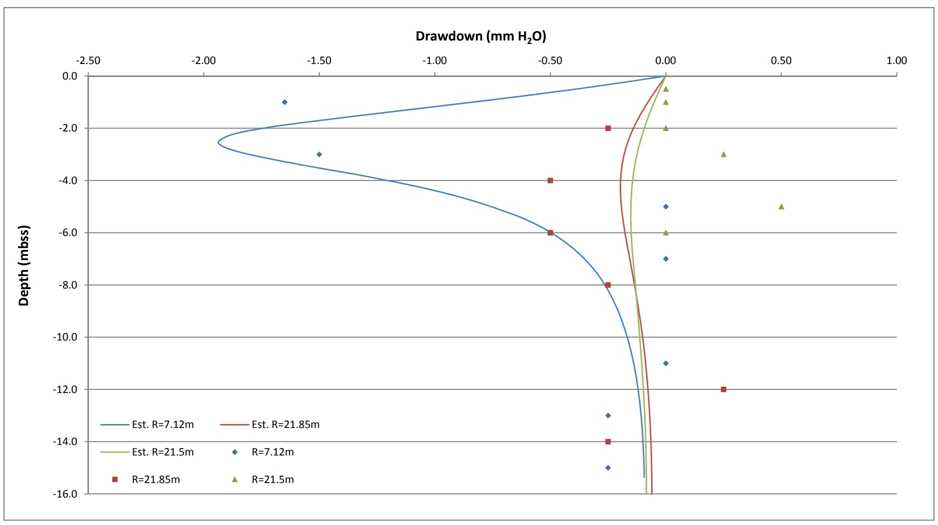
K_{gx} (m/s)	A_{gr} (-)	KD (-)
3.00E-04	0.075	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	0
-1	-1.65	-	0
-2	-	-0.25	0
-3	-1.50	-	0.25
-4	-	0	-
-5	0.00	-	0.5
-6	-	-0.5	0
-7	0.00	-	-
-8	-	-0.25	-
-11	0.00	-	-
-12	-	0.25	-
-13	-0.25	-	-
-14	-	-0.25	-
-15	-0.25	-	-
-16	-	0.25	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.51	-0.05	-0.03	0.00
-1	-0.79	-0.07	-0.05	0.74
-2	-1.69	-0.14	-0.09	0.02
-3	-1.86	-0.18	-0.12	0.27
-4	-1.12	-0.20	-0.15	0.09
-5	-0.72	-0.19	-0.15	0.94
-6	-0.48	-0.18	-0.15	0.13
-7	-0.35	-0.16	-0.14	0.12
-8	-0.26	-0.14	-0.13	0.02
-11	-0.14	-0.09	-0.10	0.02
-12	-0.12	-0.08	-0.10	0.11
-13	-0.11	-0.07	-0.09	0.02
-14	-0.10	-0.06	-0.09	0.03
-15	-0.09	-0.06	-0.08	0.02
-16	0.00	-0.06	-0.08	0.10
			Total	2.53



NOTES:

- i.e. -R=7.12m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**200909-C-ANG-2**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	20-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
4.72E-03	7.14E-03
9.44E-03	1.43E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02
4.72E-03	7.14E-03

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.74E-05	1.21	999.68

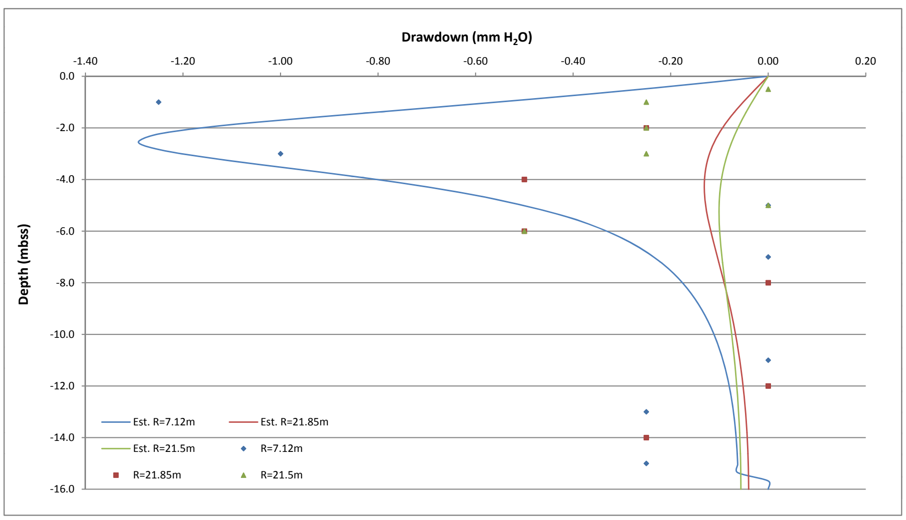
K_{gx} (m/s)	A_{gr} (-)	KD (-)
3.00E-04	0.075	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	0
-1	-1.25	-	-0.25
-2	-	-0.25	-0.25
-3	-1.00	-	-0.25
-4	-	-0.25	-
-5	0.00	-	0
-6	-	-0.5	-0.5
-7	0.00	-	-
-8	-	0	-
-11	0.00	-	-
-12	-	0	-
-13	-0.25	-	-
-14	-	-0.25	-
-15	-0.25	-	-
-16	-	-0.25	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.34	-0.03	-0.02	0.00
-1	-0.53	-0.05	-0.03	0.57
-2	-1.13	-0.09	-0.06	0.06
-3	-1.24	-0.12	-0.08	0.09
-4	-0.74	-0.13	-0.10	0.14
-5	-0.48	-0.13	-0.10	0.24
-6	-0.32	-0.12	-0.10	0.31
-7	-0.23	-0.10	-0.09	0.05
-8	-0.18	-0.09	-0.09	0.01
-11	-0.09	-0.06	-0.07	0.01
-12	-0.08	-0.05	-0.06	0.00
-13	-0.07	-0.05	-0.06	0.03
-14	-0.07	-0.04	-0.06	0.04
-15	-0.06	-0.04	-0.06	0.04
-16	0.00	-0.04	-0.06	0.04
			Total	1.58



NOTES:
- i.e. -R=7.12m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	200909-C-ANG-2	FLOW RATE 5
Client:	Syncrude Canada Ltd.	

Test Date	20-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	Flux (m/s)
4.72E-03	7.14E-03
9.44E-03	1.43E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02
4.72E-03	7.14E-03

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.74E-05	1.21	999.68

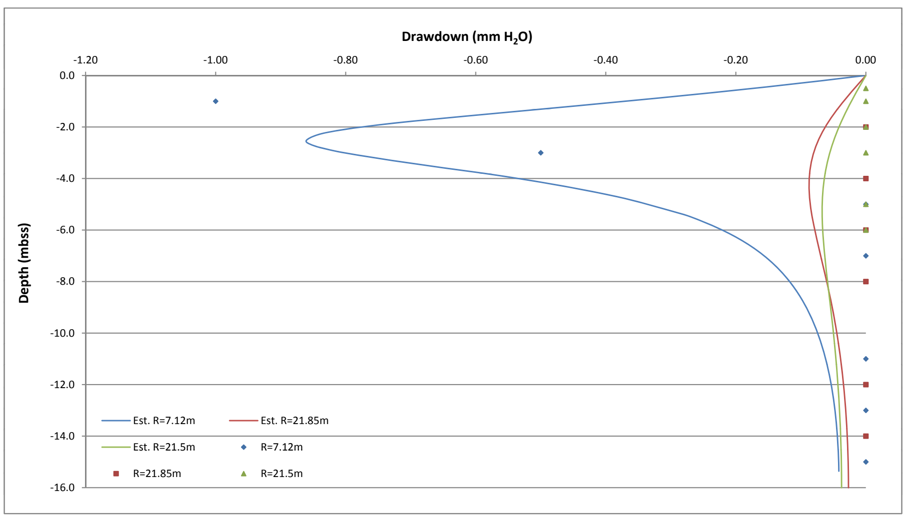
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.25E-04	0.075	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	CMT 145 R=6.46mm ($mm\ H_2O$)	CMT 146 R=17.28m ($mm\ H_2O$)	CMT 147 R=27.0m ($mm\ H_2O$)
-0.5	-	-	0
-1	-1.00	-	0
-2	-	0	0
-3	-0.50	-	0
-4	-	0	-
-5	0.00	-	0
-6	-	0	0
-7	0.00	-	-
-8	-	0	-
-11	0.00	-	-
-12	-	0	-
-13	0.00	-	-
-14	-	0	-
-15	0.00	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	CMT 144 R=7.15m TH ($mm\ H_2O$)	CMT 147 R=31.0m TH ($mm\ H_2O$)	CMT 143 R=46.0m TH ($mm\ H_2O$)	SLS ($mm^2\ H_2O$)
-0.5	-0.23	-0.02	-0.01	0.00
-1	-0.35	-0.03	-0.02	0.42
-2	-0.75	-0.06	-0.04	0.01
-3	-0.83	-0.08	-0.05	0.11
-4	-0.50	-0.09	-0.06	0.01
-5	-0.32	-0.08	-0.07	0.11
-6	-0.21	-0.08	-0.07	0.01
-7	-0.15	-0.07	-0.06	0.02
-8	-0.12	-0.06	-0.06	0.00
-11	-0.06	-0.04	-0.05	0.00
-12	-0.05	-0.03	-0.04	0.00
-13	-0.05	-0.03	-0.04	0.00
-14	-0.04	-0.03	-0.04	0.00
-15	-0.04	-0.03	-0.04	0.00
-16	0.00	-0.03	-0.04	0.00
			Total	0.70



NOTES:

- i.e. -R=7.12m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	200909-C-ANG-3	FLOW RATE 1
Client:	Syncrude Canada Ltd.	

Syncrude

Test Date	20-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	Flux (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.74E-05	1.22	999.68

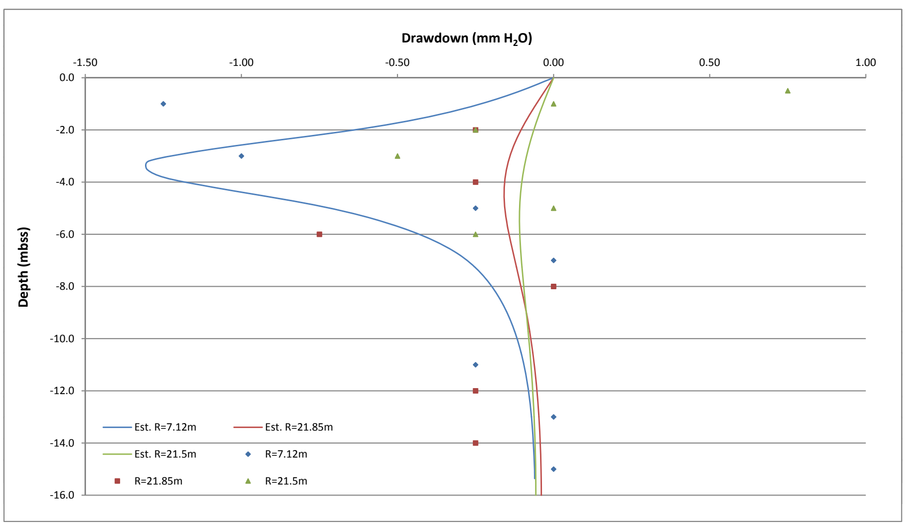
K_{gx} (m/s)	A_{gr} (-)	KD (-)
4.00E-04	0.06	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	CMT 145 R=7.12mm (mm H_2O)	CMT 146 R=21.85m (mm H_2O)	CMT 147 R=21.5m (mm H_2O)
-0.5	-	-	0.75
-1	-1.25	-	0
-2	-	-0.25	-0.25
-3	-1.00	-	-0.5
-4	-	0	-
-5	-0.25	-	0
-6	-	-0.75	-0.25
-7	0.00	-	-
-8	-	0	-
-11	-0.25	-	-
-12	-	-0.25	-
-13	0.00	-	-
-14	-	-0.25	-
-15	0.00	-	-
-16	-	1.25	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	CMT 144 R=7.12mm TH (mm H_2O)	CMT 147 R=21.85m TH (mm H_2O)	CMT 143 R=21.5m TH (mm H_2O)	SLS (mm^2 H_2O)
-0.5	-0.14	-0.04	-0.02	0.60
-1	-0.22	-0.05	-0.03	1.06
-2	-0.59	-0.10	-0.06	0.06
-3	-1.17	-0.14	-0.08	0.20
-4	-1.11	-0.16	-0.10	0.01
-5	-0.67	-0.16	-0.11	0.19
-6	-0.41	-0.14	-0.11	0.39
-7	-0.27	-0.12	-0.10	0.08
-8	-0.20	-0.10	-0.10	0.01
-11	-0.10	-0.06	-0.07	0.02
-12	-0.08	-0.05	-0.07	0.04
-13	-0.07	-0.05	-0.06	0.00
-14	-0.06	-0.04	-0.06	0.04
-15	-0.06	-0.04	-0.06	0.00
-16	0.00	-0.04	-0.06	1.66
			Total	2.70



NOTES:

- i.e. -R=7.12m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

University of Saskatchewan

Packer Test:	**200909-C-ANG-3**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	20-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.74E-05	1.22	999.68

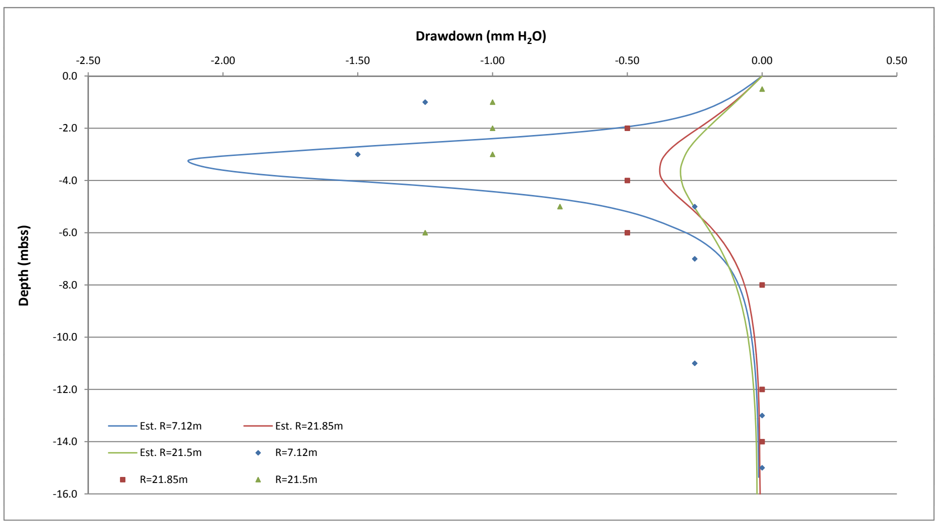
K_{gx} (m/s)	A_{gr} (-)	KD (-)
8.50E-04	0.01	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	0
-1	-1.25	-	-1
-2	-	-0.5	-1
-3	-1.50	-	-1
-4	-	-1	-
-5	-0.25	-	-0.75
-6	-	-0.5	-1.25
-7	-0.25	-	-
-8	-	0	-
-11	-0.25	-	-
-12	-	0	-
-13	0.00	-	-
-14	-	0	-
-15	0.00	-	-
-16	-	1.75	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.09	-0.06	-0.06	0.00
-1	-0.14	-0.10	-0.10	2.05
-2	-0.48	-0.22	-0.19	0.72
-3	-1.75	-0.35	-0.28	0.58
-4	-1.31	-0.36	-0.30	0.02
-5	-0.53	-0.26	-0.25	0.33
-6	-0.27	-0.17	-0.19	1.24
-7	-0.14	-0.10	-0.14	0.01
-8	-0.09	-0.07	-0.10	0.00
-11	-0.03	-0.02	-0.04	0.05
-12	-0.02	-0.01	-0.03	0.00
-13	-0.02	-0.01	-0.02	0.00
-14	-0.01	-0.01	-0.02	0.00
-15	-0.01	-0.01	-0.02	0.00
-16	0.00	-0.01	-0.02	3.09
			Total	5.02



NOTES:

- i.e. -R=7.12m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**200909-C-ANG-3**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	20-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.74E-05	1.22	999.68

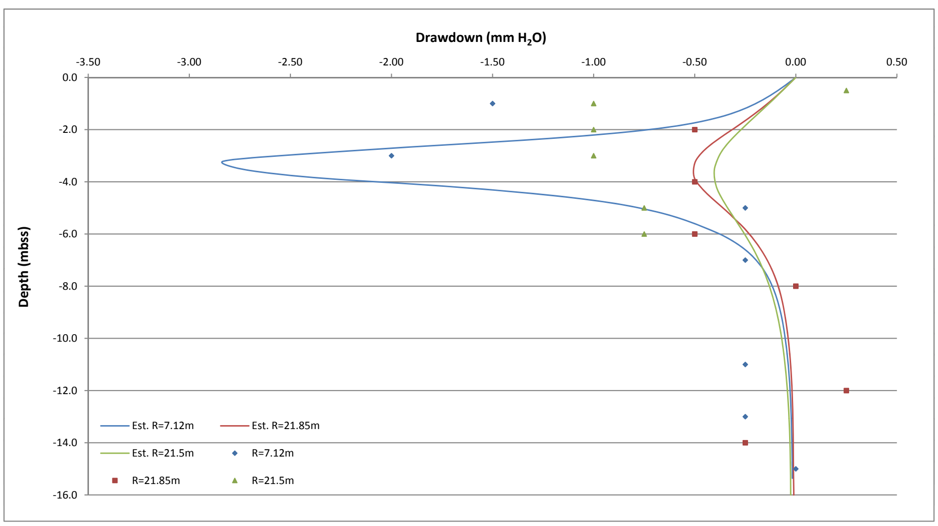
K_{gx} (m/s)	A_{gr} (-)	KD (-)
8.50E-04	0.01	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm (mm H_2O)	**CMT 146** R=17.28m (mm H_2O)	**CMT 147** R=27.0m (mm H_2O)
-0.5	-	-	0.25
-1	-1.50	-	-1
-2	-	-0.5	-1
-3	-2.00	-	-1
-4	-	-1	-
-5	-0.25	-	-0.75
-6	-	-0.5	-0.75
-7	-0.25	-	-
-8	-	0	-
-11	-0.25	-	-
-12	-	0.25	-
-13	-0.25	-	-
-14	-	-0.25	-
-15	0.00	-	-
-16	-	-0.25	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.12	-0.09	-0.08	0.11
-1	-0.19	-0.13	-0.13	2.48
-2	-0.64	-0.30	-0.26	0.59
-3	-2.33	-0.46	-0.37	0.50
-4	-1.75	-0.48	-0.39	0.00
-5	-0.71	-0.34	-0.33	0.39
-6	-0.36	-0.22	-0.25	0.33
-7	-0.19	-0.14	-0.18	0.00
-8	-0.12	-0.09	-0.13	0.01
-11	-0.04	-0.03	-0.05	0.04
-12	-0.03	-0.02	-0.04	0.07
-13	-0.02	-0.01	-0.03	0.05
-14	-0.02	-0.01	-0.03	0.06
-15	-0.02	-0.01	-0.03	0.00
-16	0.00	-0.01	-0.03	0.06
			Total	4.64



NOTES:
- i.e. -R=7.12m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**200909-C-ANG-3**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	20-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.74E-05	1.22	999.68

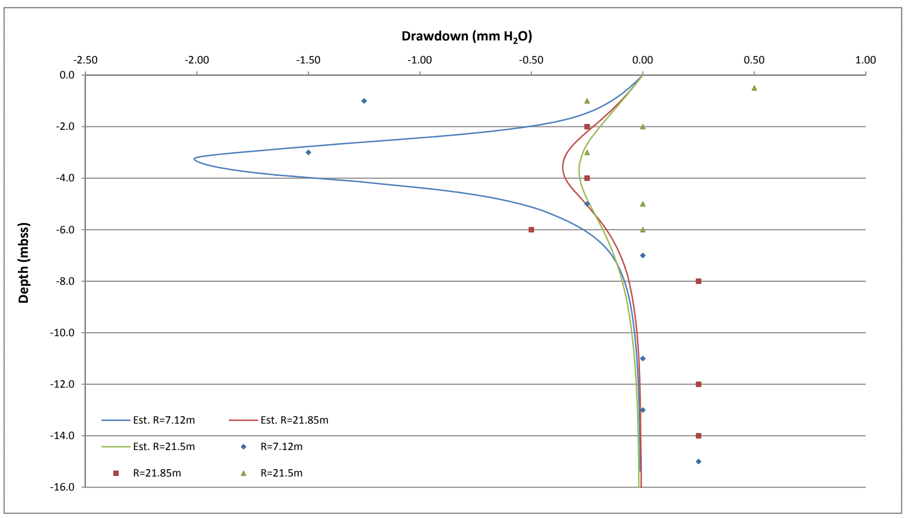
K_{gx} (m/s)	A_{gr} (-)	KD (-)
9.00E-04	0.01	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	0.5
-1	-1.25	-	-0.25
-2	-	-0.25	0
-3	-1.50	-	-0.25
-4	-	-0.25	-
-5	-0.25	-	0
-6	-	-0.5	0
-7	0.00	-	-
-8	-	0.25	-
-11	0.00	-	-
-12	-	0.25	-
-13	0.00	-	-
-14	-	0.25	-
-15	0.25	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.08	-0.06	-0.06	0.31
-1	-0.13	-0.09	-0.09	1.27
-2	-0.46	-0.21	-0.18	0.04
-3	-1.65	-0.33	-0.26	0.02
-4	-1.24	-0.34	-0.28	0.01
-5	-0.50	-0.24	-0.23	0.12
-6	-0.25	-0.16	-0.18	0.15
-7	-0.14	-0.10	-0.13	0.02
-8	-0.08	-0.06	-0.09	0.00
-11	-0.03	-0.02	-0.04	0.00
-12	-0.02	-0.01	-0.03	0.07
-13	-0.02	-0.01	-0.02	0.00
-14	-0.01	-0.01	-0.02	0.07
-15	-0.01	-0.01	-0.02	0.07
-16	0.00	-0.01	-0.02	0.00
			Total	2.14



NOTES:

- i.e. -R=7.12m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**200909-C-ANG-3**	**FLOW RATE 5**
Client:	Syncrude Canada Ltd.	

Test Date	20-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.74E-05	1.22	999.68

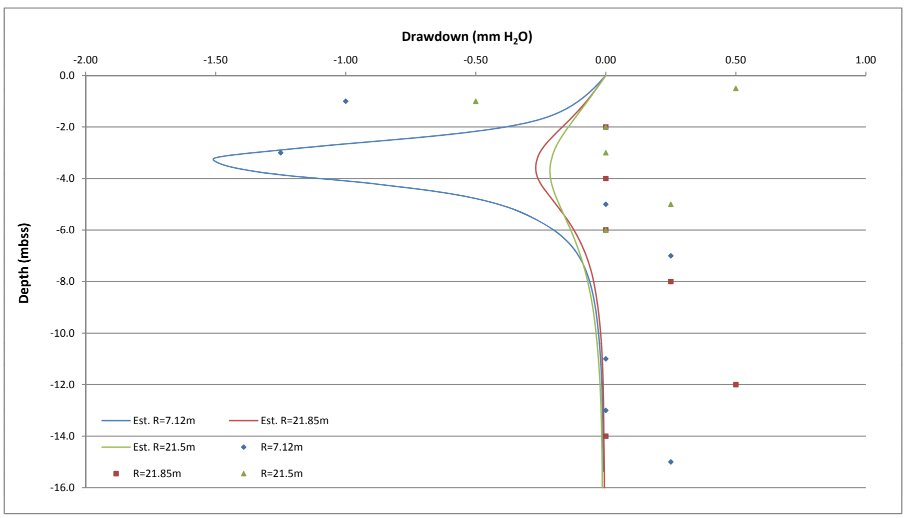
K_{gx} (m/s)	A_{gr} (-)	KD (-)
8.00E-04	0.01	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	0.5
-1	-1.00	-	-0.5
-2	-	0	0
-3	-1.25	-	0
-4	-	-0.5	-
-5	0.00	-	0.25
-6	-	0	0
-7	0.25	-	-
-8	-	0.25	-
-11	0.00	-	-
-12	-	0.5	-
-13	0.00	-	-
-14	-	0	-
-15	0.25	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.06	-0.05	-0.04	0.30
-1	-0.10	-0.07	-0.07	1.00
-2	-0.34	-0.16	-0.14	0.04
-3	-1.24	-0.25	-0.20	0.04
-4	-0.93	-0.25	-0.21	0.06
-5	-0.38	-0.18	-0.17	0.32
-6	-0.19	-0.12	-0.13	0.03
-7	-0.10	-0.07	-0.10	0.12
-8	-0.06	-0.05	-0.07	0.00
-11	-0.02	-0.01	-0.03	0.00
-12	-0.01	-0.01	-0.02	0.26
-13	-0.01	-0.01	-0.02	0.00
-14	-0.01	-0.01	-0.02	0.00
-15	-0.01	-0.01	-0.01	0.07
-16	0.00	-0.01	-0.01	0.00
			Total	2.25



NOTES:

- i.e. -R=7.12m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**200909-C-ANG-4**	**FLOW RATE 1**
Client:	Syncrude Canada Ltd.	

Test Date	20-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.74E-05	1.21	999.68

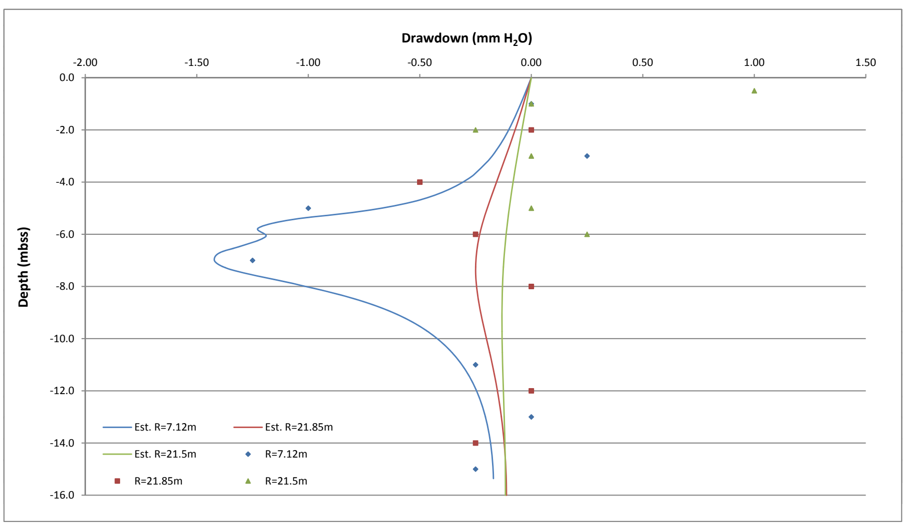
K_{gx} (m/s)	A_{gr} (-)	KD (-)
3.50E-04	0.075	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=7.12mm ($mm\ H_2O$)	**CMT 146** R=21.85m ($mm\ H_2O$)	**CMT 147** R=21.5m ($mm\ H_2O$)
-0.5	-	-	1
-1	0.00	-	0
-2	-	0	-0.25
-3	0.25	-	0
-4	-	0	-
-5	-1.00	-	0
-6	-	-0.25	0.25
-7	-1.25	-	-
-8	-	0	-
-11	-0.25	-	-
-12	-	0	-
-13	0.00	-	-
-14	-	-0.25	-
-15	-0.25	-	-
-16	-	1	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.12mm TH ($mm\ H_2O$)	**CMT 147** R=21.85m TH ($mm\ H_2O$)	**CMT 143** R=21.5m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.03	-0.02	-0.01	1.03
-1	-0.05	-0.03	-0.02	0.00
-2	-0.10	-0.07	-0.04	0.05
-3	-0.17	-0.11	-0.06	0.18
-4	-0.34	-0.16	-0.08	0.11
-5	-0.76	-0.20	-0.10	0.07
-6	-1.19	-0.23	-0.11	0.13
-7	-1.42	-0.25	-0.12	0.03
-8	-1.01	-0.25	-0.13	0.06
-11	-0.32	-0.18	-0.13	0.00
-12	-0.24	-0.15	-0.12	0.02
-13	-0.20	-0.13	-0.12	0.04
-14	-0.18	-0.12	-0.12	0.02
-15	-0.17	-0.11	-0.12	0.01
-16	0.00	-0.11	-0.12	1.24
			Total	1.75



NOTES:
- i.e. -R=7.12m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

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Packer Test:	**200909-C-ANG-4**	**FLOW RATE 2**
Client:	Syncrude Canada Ltd.	

Test Date	20-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.74E-05	1.21	999.68

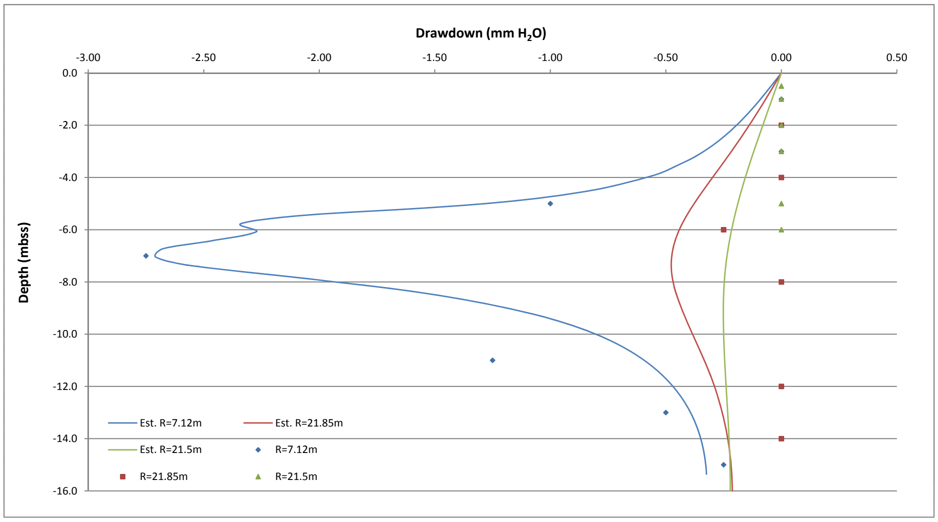
K_{gx} (m/s)	A_{gr} (-)	KD (-)
2.75E-04	0.075	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm (mm H_2O)	**CMT 146** R=17.28m (mm H_2O)	**CMT 147** R=27.0m (mm H_2O)
-0.5	-	-	0
-1	0.00	-	0
-2	-	0	0
-3	0.00	-	0
-4	-	0	-
-5	-1.00	-	0
-6	-	-0.25	0
-7	-2.75	-	-
-8	-	0	-
-11	-1.25	-	-
-12	-	0	-
-13	-0.50	-	-
-14	-	0	-
-15	-0.25	-	-
-16	-	0	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH (mm H_2O)	**CMT 147** R=31.0m TH (mm H_2O)	**CMT 143** R=46.0m TH (mm H_2O)	**SLS** (mm^2 H_2O)
-0.5	-0.06	-0.04	-0.03	0.00
-1	-0.09	-0.07	-0.04	0.01
-2	-0.19	-0.13	-0.08	0.02
-3	-0.32	-0.21	-0.11	0.11
-4	-0.65	-0.31	-0.16	0.10
-5	-1.45	-0.39	-0.19	0.24
-6	-2.27	-0.45	-0.22	0.09
-7	-2.71	-0.47	-0.24	0.00
-8	-1.93	-0.47	-0.25	0.22
-11	-0.61	-0.34	-0.25	0.41
-12	-0.45	-0.28	-0.24	0.08
-13	-0.39	-0.25	-0.23	0.01
-14	-0.35	-0.23	-0.23	0.05
-15	-0.33	-0.22	-0.22	0.01
-16	0.00	-0.21	-0.22	0.05
			Total	1.35



NOTES:
- i.e. -R=7.12m is the radial distance between the test location and monitoring location
-mbss is 'meters below sulphur block surface
-TH is "Total Head'

Packer Test:	**200909-C-ANG-4**	**FLOW RATE 3**
Client:	Syncrude Canada Ltd.	

Test Date	20-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.74E-05	1.21	999.68

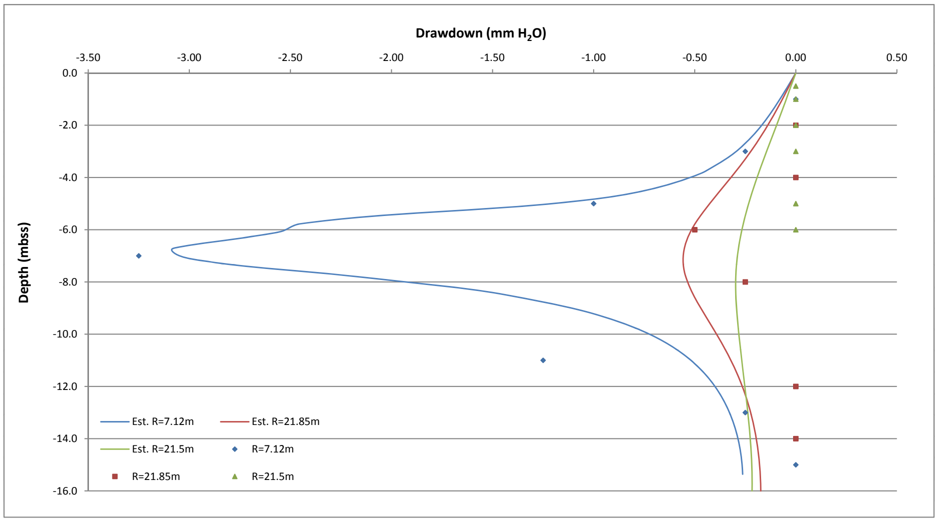
K_{gx} (m/s)	A_{gr} (-)	KD (-)
4.00E-04	0.05	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	0
-1	0.00	-	0
-2	-	0	0
-3	-0.25	-	0
-4	-	0	-
-5	-1.00	-	0
-6	-	-0.5	0
-7	-3.25	-	-
-8	-	-0.25	-
-11	-1.25	-	-
-12	-	0	-
-13	-0.25	-	-
-14	-	0	-
-15	0.00	-	-
-16	-	0.5	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.05	-0.04	-0.03	0.00
-1	-0.08	-0.06	-0.05	0.01
-2	-0.16	-0.13	-0.09	0.03
-3	-0.28	-0.21	-0.14	0.02
-4	-0.58	-0.34	-0.20	0.11
-5	-1.39	-0.44	-0.24	0.21
-6	-2.55	-0.52	-0.27	0.07
-7	-3.03	-0.56	-0.29	0.05
-8	-1.93	-0.54	-0.30	0.29
-11	-0.54	-0.33	-0.27	0.51
-12	-0.39	-0.26	-0.25	0.07
-13	-0.32	-0.22	-0.24	0.01
-14	-0.28	-0.19	-0.23	0.04
-15	-0.27	-0.18	-0.22	0.07
-16	0.00	-0.17	-0.22	0.45
			Total	1.47



NOTES:

- i.e. -R=7.12m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**200909-C-ANG-4**	**FLOW RATE 4**
Client:	Syncrude Canada Ltd.	

Test Date	20-Sep-09
Test Interval Temperature (°C)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.74E-05	1.21	999.68

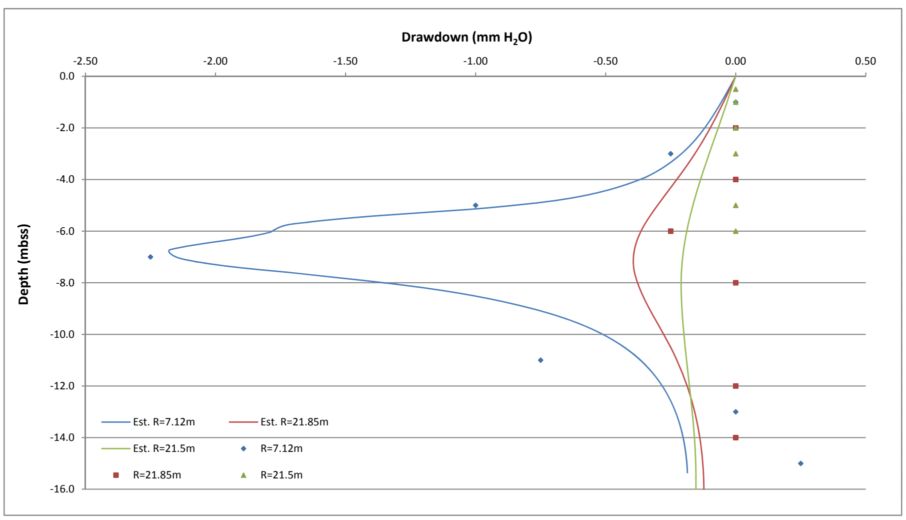
K_{gx} (m/s)	A_{gr} (-)	**KD** (-)
4.25E-04	0.05	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	0
-1	0.00	-	0
-2	-	0	0
-3	-0.25	-	0
-4	-	0	-
-5	-1.00	-	0
-6	-	-0.25	0
-7	-2.25	-	-
-8	-	0	-
-11	-0.75	-	-
-12	-	0	-
-13	0.00	-	-
-14	-	0	-
-15	0.25	-	-
-16	-	0.5	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.03	-0.03	-0.02	0.00
-1	-0.05	-0.04	-0.03	0.00
-2	-0.11	-0.09	-0.07	0.01
-3	-0.20	-0.15	-0.10	0.01
-4	-0.41	-0.24	-0.14	0.06
-5	-0.98	-0.31	-0.17	0.03
-6	-1.80	-0.37	-0.19	0.05
-7	-2.14	-0.39	-0.20	0.01
-8	-1.36	-0.38	-0.21	0.14
-11	-0.38	-0.23	-0.19	0.14
-12	-0.27	-0.18	-0.18	0.03
-13	-0.23	-0.15	-0.17	0.05
-14	-0.20	-0.14	-0.16	0.02
-15	-0.19	-0.13	-0.15	0.19
-16	0.00	-0.12	-0.15	0.39
			Total	0.75



NOTES:

- i.e. -R=7.12m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'

Packer Test:	**200909-C-ANG-4**	**FLOW RATE 5**
Client:	Syncrude Canada Ltd.	

Test Date	20-Sep-09
Test Interval Temperature (^oC)	13.5
Ambient Barometric Pressure (kPa)	100.4
Center of Test Interval (mbss)	1.73
Borehole Diameter (m)	0.076
Test Inverval Length (m)	1.38
Borehole Area (m^2)	0.66

Flowrate (m^3/s)	**Flux** (m/s)
9.44E-03	1.43E-02
1.42E-02	2.14E-02
1.89E-02	2.86E-02
1.42E-02	2.14E-02
9.44E-03	1.43E-02

μ_g (Pa s)	ρ_g (kg/m^3)	ρ_w (kg/m^3)
1.74E-05	1.21	999.68

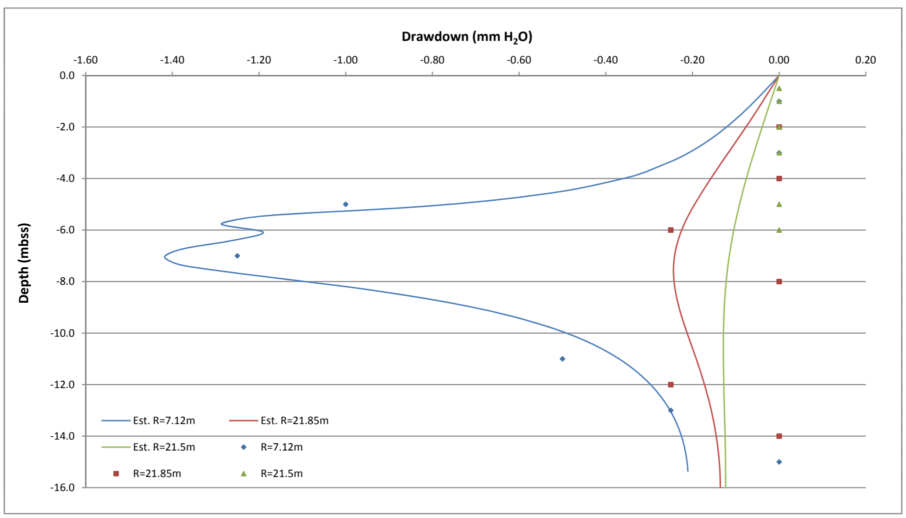
K_{gx} (m/s)	A_{gr} (-)	KD (-)
3.00E-04	0.1	0

Corrected Data - Net Differential Manometer Measurement (mm H2O)

Port Depth (mbss)	**CMT 145** R=6.46mm ($mm\ H_2O$)	**CMT 146** R=17.28m ($mm\ H_2O$)	**CMT 147** R=27.0m ($mm\ H_2O$)
-0.5	-	-	0
-1	0.00	-	0
-2	-	0	0
-3	0.00	-	0
-4	-	0	-
-5	-1.00	-	0
-6	-	-0.25	0
-7	-1.25	-	-
-8	-	0	-
-11	-0.50	-	-
-12	-	-0.25	-
-13	-0.25	-	-
-14	-	0	-
-15	0.00	-	-
-16	-	1	-

Simulated Drawdown at Monitoring Locations

Port Depth (mbss)	**CMT 144** R=7.15m TH ($mm\ H_2O$)	**CMT 147** R=31.0m TH ($mm\ H_2O$)	**CMT 143** R=46.0m TH ($mm\ H_2O$)	**SLS** ($mm^2\ H_2O$)
-0.5	-0.04	-0.02	-0.01	0.00
-1	-0.05	-0.04	-0.02	0.00
-2	-0.12	-0.07	-0.04	0.01
-3	-0.20	-0.11	-0.06	0.04
-4	-0.40	-0.16	-0.08	0.03
-5	-0.85	-0.20	-0.09	0.03
-6	-1.19	-0.23	-0.11	0.01
-7	-1.42	-0.24	-0.12	0.03
-8	-1.09	-0.24	-0.12	0.06
-11	-0.38	-0.19	-0.13	0.01
-12	-0.29	-0.17	-0.13	0.01
-13	-0.25	-0.16	-0.13	0.00
-14	-0.22	-0.14	-0.12	0.02
-15	-0.21	-0.14	-0.12	0.05
-16	0.00	-0.14	-0.12	1.29
			Total	0.30



NOTES:

- i.e. -R=7.12m is the radial distance between the test location and monitoring location

-mbss is 'meters below sulphur block surface

-TH is "Total Head'